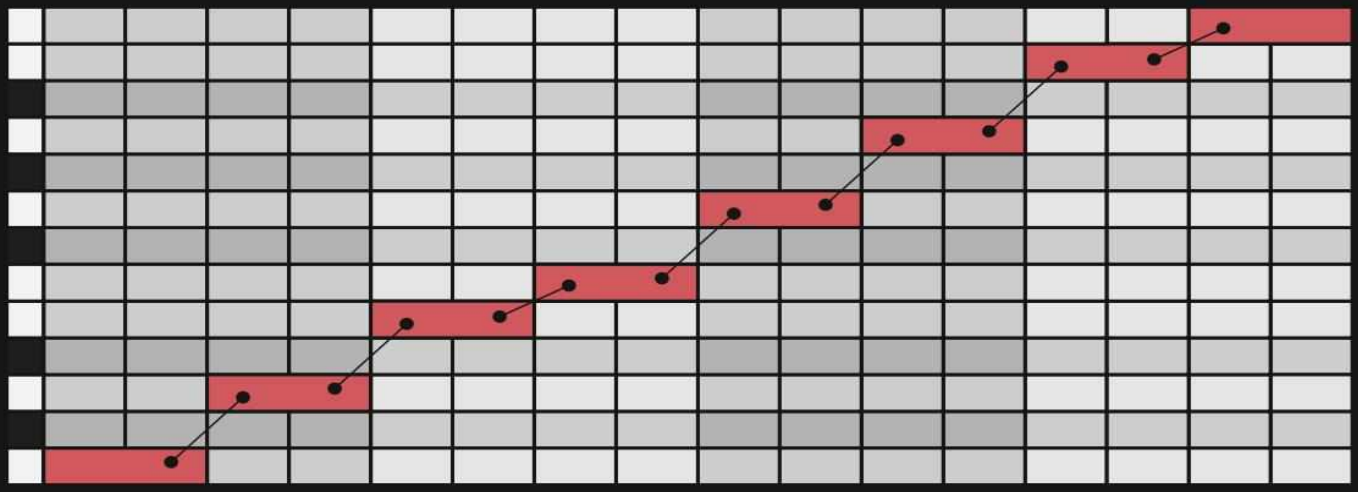
Music Theory for Electronic Music Producers

The producer's guide to harmony, chord progressions, and song structure in the MIDI grid.



J. Anthony Allen, PhD

SLAM ACADEMY

EDITION 2

Music Theory for Electronic Music Producers

The Producer's Guide to Harmony, Chord Progressions, and Song Structure in the MIDI Grid

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To my Slam family (Slam Academy) and
to my real family (Erin and Scully).

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1. Introduction

Music Theory is the green vegetable of electronic music. You know that it's good for you, you know that it will make you a better producer. But why spend time learning it when you could launch your software and rock out some chocolate-sauce covered beats? In the long run, we all know it will be good for us to learn, but it's tedious, complicated, and boring. With this book, I can't turn broccoli into ice cream, but what I can do is help you through the process of learning music theory in a simple way, specific to electronic music, that cuts down on the technical jargon and makes the whole thing go down smoother.

1.1 What is Music Theory?

Simply put: Music theory is knowing what notes are going to sound good together in context. Let's pick that sentence apart a bit:

Music Theory is knowing...

What we want to be able to use music theory for is predicting, while we are in the moment of producing, what our options are. You should be able to run through a few concepts and say to yourself, "Ok, we are on this type of chord, so I have a few common options". But you will know quickly what your options are for chords and notes that will sound good.

Music Theory is knowing what notes are going to sound good...

Good, in this context, doesn't mean happy, or harmonious, or anything like that. It means they are going to fit in with the notes around them. They might be dissonant, abrasive notes, but if that is what our track is all about, then that is what we want. It is important to remember - and I'll remind you of this constantly throughout this book - that if we always put the notes that sound happy or harmonious we are going to end up with an entirely predicable and boring track. Sometimes you have to break the rules, and in this book that is encouraged.

Music Theory is knowing what notes are going to sound good together in context.

Let's say you are writing music for a video game. In one scene, the character is in the wild west. In the next, he gets into a time machine and is now a knight in a medieval era. Oh, and you have two hours to write all the music for both scenes. Music Theory to the rescue. We know what chords and scales are common in both eras. In the first scene, we would think about what scales and chords sound appropriate to that context. We would then produce as much music as we could using those elements, before we switch context to the the medieval era. We then would grab a new set of scales and chords that sound good in that context. You still have a lot of creative work to do, but you've skipped ahead on all the exploring

of sounds that you would have done if you didn't know that both of those eras have a set of chords and scales you can use to quickly make the listener feel like the music is in context.

1.2 The Most Important Rule of Music Theory

I approach music theory from the perspective of a composer and producer. Not as an academic music theoretician. The rules that we will cover in this book have been around for centuries, and they tend to work well for making "good" sounding music. But music is a constant evolution of experimentation and rule-breaking. As a producer, when I talk about music theory I have one rule on this that I insist you keep in mind while using music theory:

Rule No. 1: Don't let music theory be a bully. Your ear always wins.

I often have students come to me with a partially completed track and tell me that they came up with a chord progression they liked, but it didn't make sense, so they changed it. This makes me cry a little bit. It didn't "make sense"? If it sounded good to you, then it made sense. You are letting music theory tell you how you should write your track, and that is not the role of music theory. Your ear always wins: If it sounds good to you, then go with it. Break the rules. Make your own theory. It is, after all, just a theory.

Music Theory gives us clues and guidance while we are writing, and helps us to know what will sound good. But it should never be in the drivers seat when you are in your creative mode. Let it be the navigator, but don't be afraid to make your own roads. Innovative music always comes with the risk of driving off a cliff. Embrace it.

1.3 Our Method: No Pianos, No Singing

Traditionally, when you study music theory in a college class, you actually take three classes at once: Music Theory, Sight Singing (sometimes called Aural Skills), and Piano Skills. The idea is that you study the concepts of music theory, and at the same time you reinforce it by learning to sing (by just looking at sheet music) some of the concepts, and then you nail it home by learning to play it on the piano. This method has been around a very long time, and has it's advantages. I'm not going to tell you that it is a bad method for teaching music theory. But this book isn't for people in a college music theory class.

This book is for people who are producing music in software (or hardware) and realizing that they need better control over picking what notes to use for their melodies, harmonies, and even percussion. Learning to sing and play the piano are not bad skills to have at all, but in this book I've found another way to teach music theory. Instead of learning to play the piano, we are going to be using the Piano Roll Editor - available in any software that you choose to use. We will be skipping over some of the music theory lingo in favor of focusing on how something sounds, and how you can use it in your tracks.

I'll be using Ableton Live for all the screenshots in this book, but because we are only using the Piano Roll Editor, you can use any software you like. As long as it has a Piano Roll Editor, you will be fine using any other program.

1.4 Do As I Say and Do

Another thing we will be doing throughout this book is dissecting some popular tracks that you have probably heard before. We will look at the chords they used and figure out how and why it works the way it does. In each of these analysis sections, you can input the notes into your software and follow along. All the examples I'll be giving you work best when you hear them. Seeing them is nice, but it is no comparison to hearing them. After that, you can experiment with the track and see if you can find some new and interesting chords using the analysis as a starting point.

For best results: follow along with the examples and listen to them.

1.5 A Bit About Me

I started making music as a guitar player when I was pretty young. I got hooked on it, and went to college for music composition. While I was in college one of my professors turned me on to electronic music and I became fascinated with it. I continued my studies in graduate school, eventually earning a Ph.D. in Music Composition, started teaching composition and theory at the college level, and shortly thereafter went through the program to become an Ableton Certified Trainer. I'm more than just a theory-nerd, I produce music myself - my last album reached into the top 100 on the CMJ charts, and it's subsequent remix album made it to the top 25 on the CMJ charts.

In 2011 I started Slam Academy, a company that focuses on training students in a non-degree setting in DJing, Production, Recording, and similar topics. I realized through my students at Slam Academy that the typical electronic music producer has a very different background than me when it comes to music theory. In my "academic" education, it was a given that everyone knows music theory if you are going into composition. You have to study a lot of music theory in those programs. But people practing producing tend to dive headfirst into making tracks, and don't study theory at all. So I started talking to students about music theory, developed a method for teaching it that is focused on electronic music, and that led me to writing this book. I hope you enjoy it. ►

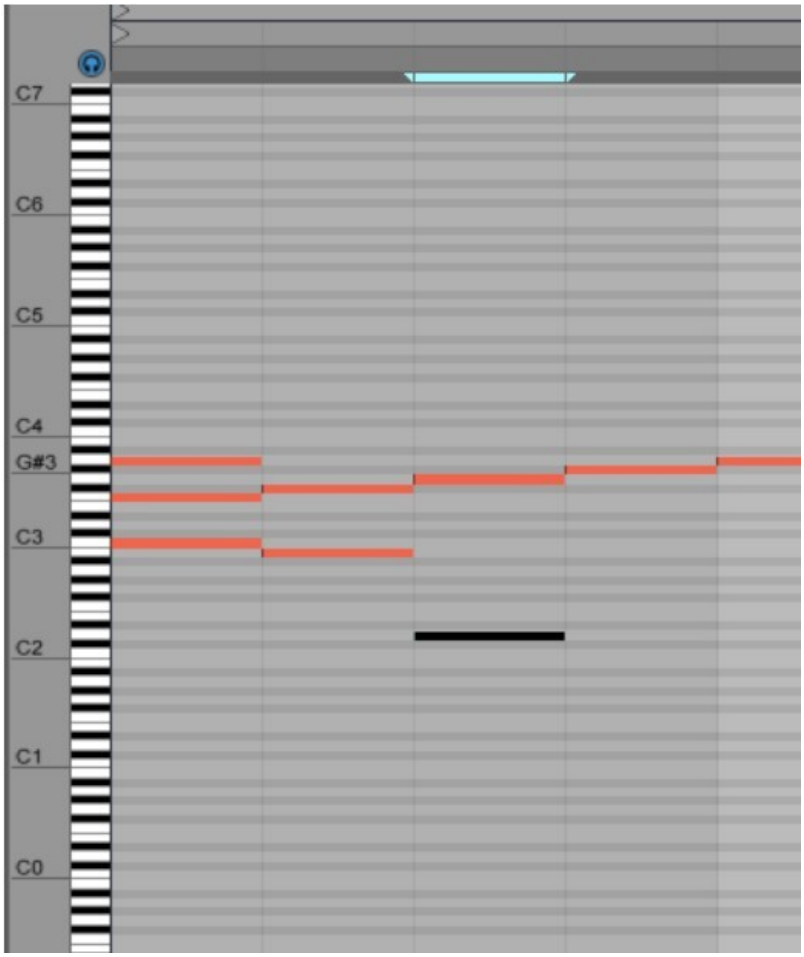
J. Anthony Allen

2. The Keyboard Layout

As promised, we are not going to spend much time at the piano. However, the piano is the fundamental model for the keyboard and (for better or worse) our DAW (Digital Audio Workstation) is built around the piano model. So we need to understand the basic layout of the keyboard in order to fully understand what our DAW is showing us.

2.1 Why Do We Care About Pianos?

Every music production program that I'm aware of uses a Piano Roll Editor. This is the name of the system we use to lay out MIDI (Musical Instrument Digital Interface) notes on a grid. When we play a sequence, a playhead will read the Piano Roll Editor from left to right, playing notes near the bottom as low notes, and notes near the top as high notes. Before we get too far along, we need to learn a few more things about how this is working.



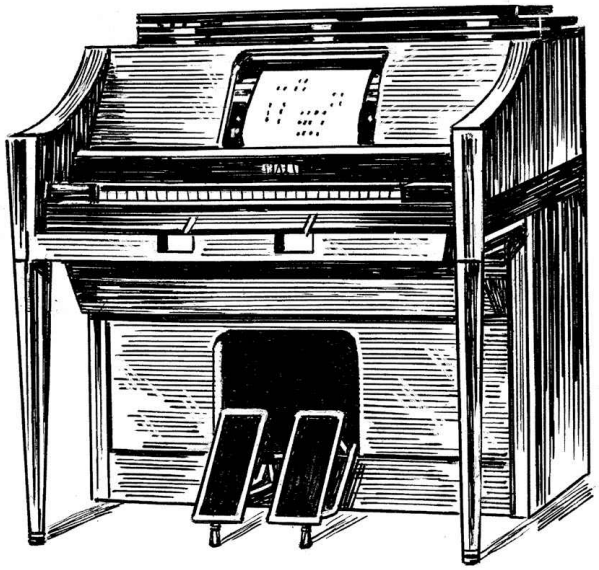
The piano roll editor from Ableton Live

2.2 A Brief History of the Piano Roll Editor

The Piano Roll Editor is an often understated tool for displaying notes. Despite all of the new technology packed into our audio sequencing software, the Piano Roll Editor makes it's first appearance all the way back in the year 1800.

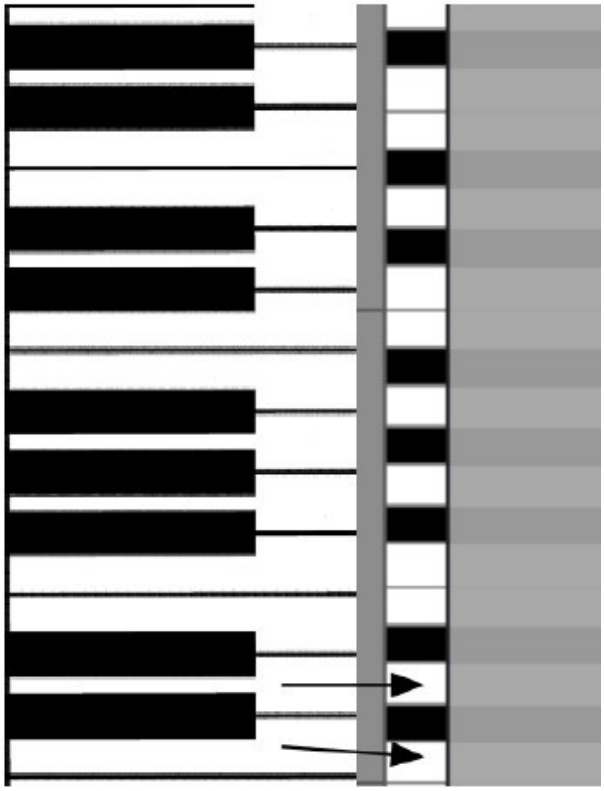
It was in 1800 that a Frenchman name Jacquard Mills first developed an automatically playing piano using punch cards (interestingly based originally on a loom). About 20 years later, paper rolls replaced punch cards, and the Player Piano was born. The Player Piano would read a sheet of paper with holes punched out at different points that represented the different keys on the piano. The roll was slowly pulled over an airway, which pushed through the paper in places that had holes, and the keys were then struck.

The sheet of paper pulled over the airway looked and acted exactly like the Piano Roll Editor that we still use today. The only real difference between our modern digital equivalent and the 1800 version is that the old paper rolls read from top to bottom, instead of left to right. Ours is digitally created, so we don't need to spend weeks and weeks to input a piece of music with scissors and a hole puncher.



2.3 Finding the Piano in the Piano Roll Editor

The piano roll editor is really just a piano, turned on it's side.



In the image below, look at bottom keys with the arrow on them. On the left, we have a typical piano keyboard laid on it's side. On the right, the piano roll editor from Ableton Live. The arrows are connecting the notes on the keyboard to the notes on the piano roll.

Let's look at this a different way. Look at the piano keyboard on the left side above, and look especially at the black keys. They are arranged in a group of two black keys, then a space, then a group of three black keys, then a space, then two, then three, and so on. Now look at the piano roll editor. You will find that same group of black keys: two, then a space, then three, then a space, etc.

So our piano roll editor is nothing but a piano keyboard laid on it's side, but it is a convenient way to look at all the notes we have access to, from

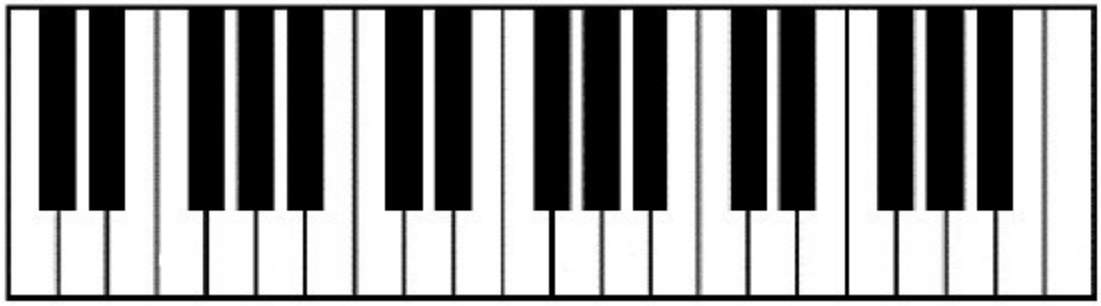
low to high. It's been working great for over 200 years, so why change it? You don't mess with perfection.

2.4 Navigating The Keyboard

The piano is a series of white and black keys, that goes from low (left side of the piano/bottom of the Piano Roll Editor) to high (right side of the piano/top of the Piano Roll Editor). The piano is made up of strings, which are hit by hammers when you press down a key. The string-hammer-key mechanism doesn't concern us too much; we need to understand how the keys are laid out.

At it's most basic, the keyboard is a series of white keys and black keys, which show different arrangements of semi-tones and whole-tones.

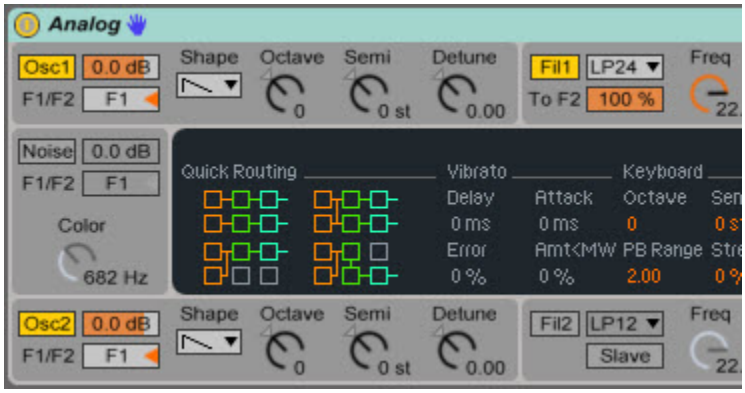
2.5 Semi-Tones



The Keyboard

Let's take a quick detour over to a synthesizer. In any modern synthesizer, you will see at least three different knobs for tuning. Usually you can find these near the oscillator. Most of the time they will be labeled "Octave", "Semi" and "Fine." There is no standardization for what we call these knobs, so they might be labeled a little differently on some synthesizers.

"Detune" in this case is the same as "Fine"

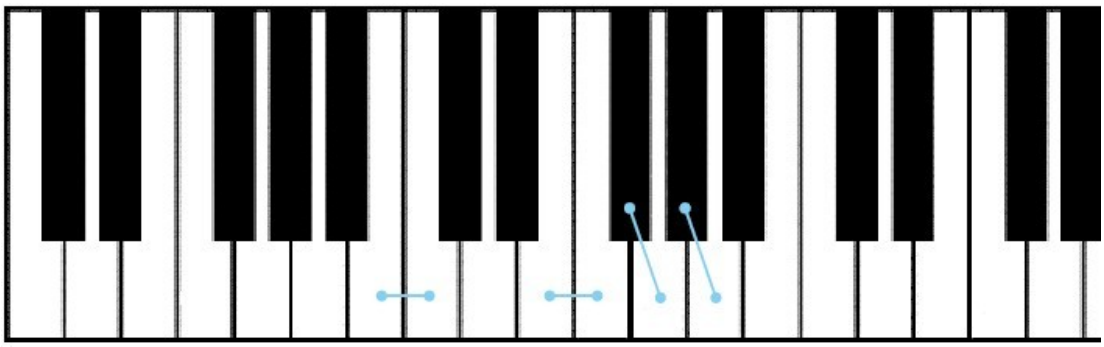


Ableton Live Analog Synthesizer

Notice in the figure above that the adjustment amount on the Semi knob is listed as "0 st." ST, in this case, stands for "Semi-tones". This adjustment knob will de-tune your synthesizer by semi-tones. A semi-tone is the smallest musical value we have [1] - that is to say, it is the smallest amount you can move on a keyboard. If you take two adjacent notes on a keyboard, they are a semi-tone apart.

[1] In some music popular in the mid-20th Century, composers experimented with creating musical intervals smaller than a semitone. These are typically called quarter-tones. See the music of Henry Cowell, John Cage, and others for more on quarter-tones. In modern electronic music production they are largely non-existent.

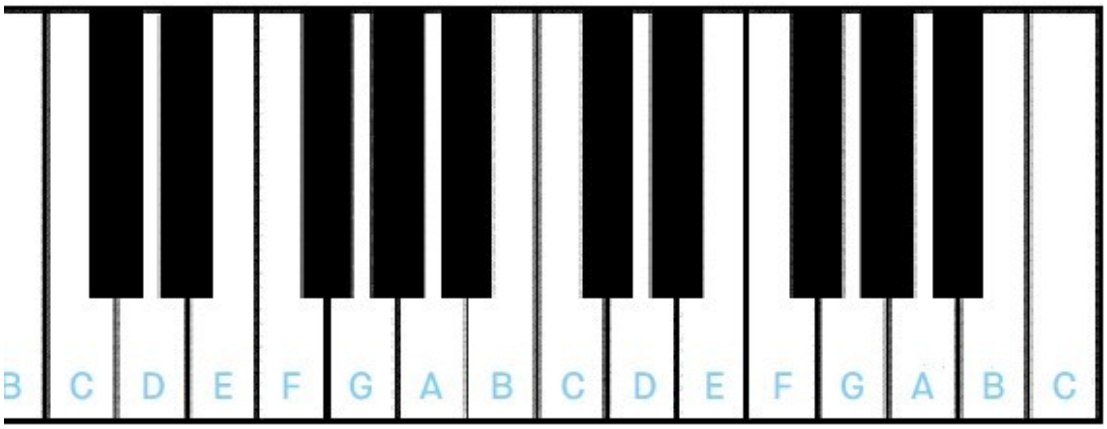
Semi-tones are marked with blue colored lines



2.6 Black and White Keys

Before we get too far along, we should define "adjacent notes" on a keyboard. That includes both the black keys and the white keys. The keyboard is organized into black and white keys for a few different reasons: the shape of the hands, tradition, and the evolution of the instrument. The most important to us in our understanding of the keyboard is the naming of the notes.

In English, all the white notes are given letter names from A through G. After G it starts over again.



Keyboard with pitch names

The black keys are named as relative to their nearest white note. A black key will always have a modifier that means "a semitone higher than" or "a semitone lower than". Remember that a semi-tone is the smallest musical value we have; the "semitone higher than" symbol means that the note is one adjacent key higher than the other.

Let's focus in on the first A that is labeled in our keyboard above (fig 2.3). What is the name of the black key just above and to the right of the A?

We could call it "A, a semitone higher". Conveniently, we have symbols that we can substitute for "a semitone higher." The symbol is called A-Sharp, or #. So that pitch would correctly be called A#, pronounced, "A-Sharp".

Let's look at another one. Look at the pitch C on the keyboard. What is the pitch just above and to the right of it? It is "C, a semitone higher" - so it would be a C#. (pronounced C Sharp).

You can take any white-key pitch, go up to the nearest black key and it will be called the sharp of the original pitch. But what about a case like B? If you go up a semitone from B, there is no black key. A semitone higher than B is C, which is a white key. For that reason, there is no such thing as B#. The same is true for E - there is no E#. [2]

> [2] As you get more advanced in Music Theory, you might come across a situation in which we call a note B# or E#. It can exist, and has a good reason to. But in modern electronic music production, it is extremely rare and unlikely.

2.7 Flats, Sharps, and Naturals

Let's go back and look at the first A in our diagram again. We could call the black key just to the left of the A an "A, a semitone lower." For that, we would use the word "flat", meaning a semitone lower. So we would pronounce that note as A-flat, or A ♭. Let's look at the first D on the keyboard in figure 2.3. The black key to the left of it is called D-flat, or D ♭.

Just like the sharps, not all notes have flats. If there is no black-key to the left of a note, it doesn't have a flat. Such as C (there is no C ♭) and F (there is no F ♭). We sometimes call the white notes "Natural": meaning they have no sharp or flat on them.

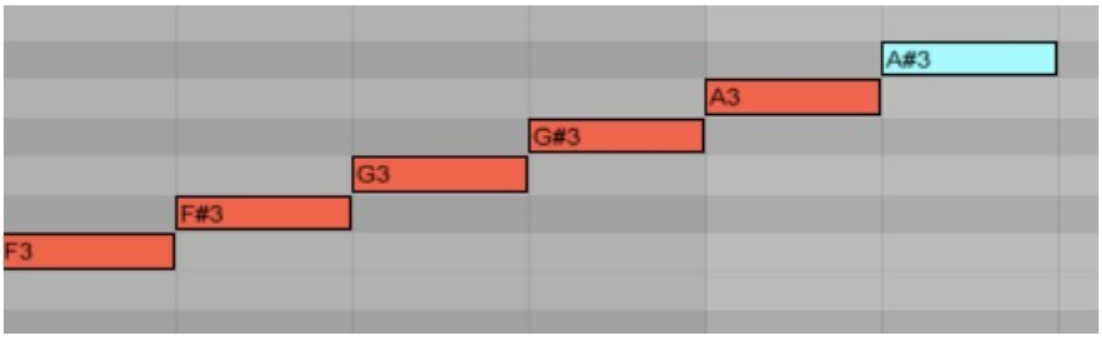
2.8 Enharmonic Notes

Now look at the pitch C, and the black note above it. It is a semitone higher than C, so we will call it C#. Now let's look at the pitch D, and look at the black note below it. It is a semitone lower, so we will call it D ♭.

Now we have a problem! The same key has two names: C# and D ♭.

So which is correct? They both are.

These notes are called "enharmonic." Enharmonic means that the two pitch names (C# and D ♭) will produce the same sounding pitch. Whether or not we call that pitch a C# or a D ♭depends on the context. What key we are in will determine which is the correct name for the pitch. We will work more with that later when we start talking about keys.



When you are working in a DAW, this can be simplified because most DAWs will only show sharps.

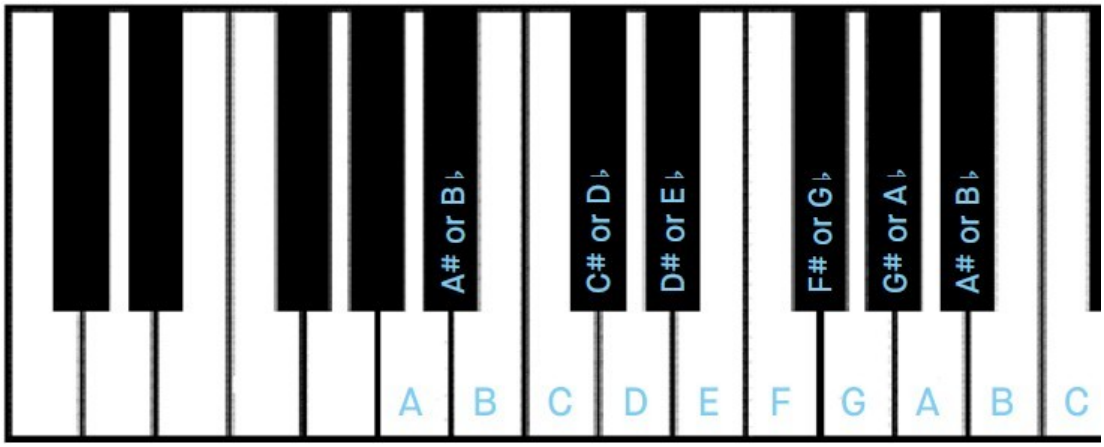
It will label all black keys as sharps. In this book I will try to favor sharps, but in some cases we will need to talk about pitches as being flat. It will be important to remember the notes that are enharmonic. They are:

C# and D ♭ D# and E♭

[E# and F ♭- neither of these two notes exist.]

F# and G ♭ G# and A ♭ A# and B ♭

[B# and C ♭- neither of these two notes exist.]



2.9 Whole-Tones

We don't typically have a knob on a synthesizer labeled for whole-tones in the same way we do for semi-tones. A whole-tone is just two semi-tones. The pitches A and B are a whole-tone apart, as are the pitches D and E. You can see on the keyboard that there is one key in between, which means these are a whole-tone apart. It is important to remember that whole-tones exist between all tones, even if it includes a black note. For example, a whole-tone away from E is F#. A whole-tone away from F# is G#. There needs to be one black or white key in between for it to be a whole-tone interval.

A semi-tone is also often referred to as a half-step. A whole-tone is also known as a whole-step. In traditional music theory, we use the words "half step" and "whole step" more often, and in synthesis we like to use the terms semi-tone and whole-tone. Remember that they mean the same thing.

2.10 The 'Semi' and 'Detune' Knob on our Synth

Let's jump back to looking at a synthesizer. When you look at the oscillator tuning section, we have the three knobs we saw earlier: Octave, Semi, and Detune. Remember that "Detune" can have a variety of different names, including "Fine", "Cent", or others.

If we set the Semi knob to 1, then everything we play on the keyboard will sound one semi tone (or one half step) higher. If we set it to 2, then everything we play will sound one whole step higher. For example: if I play a C on the keyboard, but have the Semi knob set to 2, I will hear a D; if I have it set to 3, I will hear a D# (three semi tones).

A semitone is the smallest musical distance we can move, but there are still more sounds that happen in between the notes. We measure those sounds in terms of cents. There are 100 cents in a semitone. If you play the C key on your keyboard, and have the cents knob set to 100 [3], you will hear a C#. If you have it set to 50, you will hear a pitch somewhere between C and C#, which depending on the context could sound out of tune. (Detuning oscillators are useful for synthesis.)

> [3] On many synthesizers you can't actually do this: The cent knob will only let you go up to 50, and down to -50.

100 of "Detune" = 1 of "Semi"

We still need to deal with that Octave knob - but first I want to get us grounded by focusing a whole chapter on a single pitch: C. (It's the only time we will do this - don't worry. I'm not devoting an entire book to different pitches). Once we get comfortable with a few concepts around C, Octaves will be a snap. ►

3. Finding C

The next step in understanding our keyboard layout is understanding what pitches are where. This is important because throughout this book I'm going to refer to pitches by their name, and you need to be able to find them. Once we start dealing with chords this will be even more important because you will need to be able to find the notes for any chord given a certain pitch (more on this later). But as promised, we are not going to spend any time on traditional music notation - you will not need to learn to read notes on a staff to master the fundamentals of music theory. [1]

[1] Although, it is a handy skill, I recommend learning how to do it anyway.

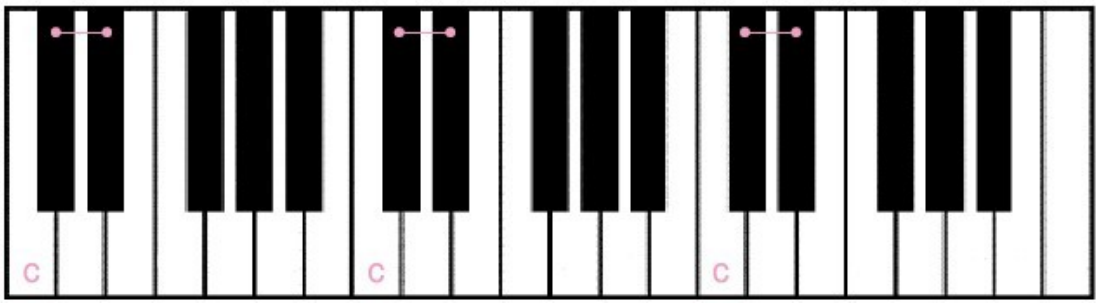
3.1 Why C?

The pitch C is often used as the starting point, and basic building block for understanding music concepts. You might expect A to be the best note to start from because it is at the beginning of the alphabet. But C has some special properties that make it easier to understand than other notes.

Remember the arrangement of black keys and white keys: two black keys, a space, then three black keys, a space, and so on. Because of that arrangement, it works out that you can play a C major scale by just playing white notes. You can randomly put your hands on the keyboard all day long and as long as you only play white keys, you will be "in the key of C". We will talk in depth about keys later, but that is the reason we like to start with C.

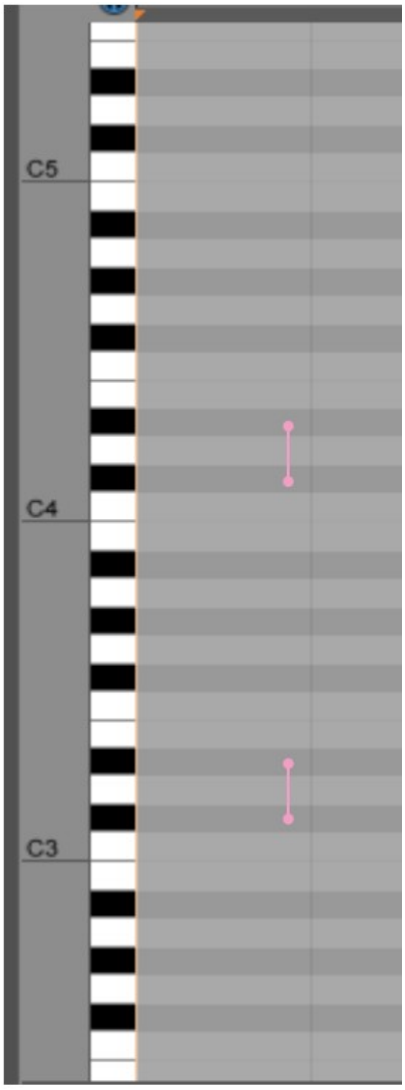
3.2 Locating C

The pitch C will always be the white key to the left of a group of two black keys.



Remember that we only have seven note names and then they start over. If you count up from any of the Cs labeled in the diagram above, the next white note will be D, then E, then F, then G. After G it starts over on A, then B. Remember when you are counting up in this way that only white keys have letter names. The black keys are named by their relation to their nearest white key (C# is "C, a half-step higher" for example).

Pairs of black keys are marked with pink colored lines.



No matter what kind of keyboard you are looking at it, or what kind of sequencer, the location of C will always be the same. The only difference is that when we look at our Piano Roll Editor, the C is under the group of two black notes (remember that left means lower on the piano), because the piano is laid out vertically.

You can see in the image above that the C is already labeled by the software. Most audio software does this for you, but some do not. Regardless, it is worth learning to find middle C without any labels.

3.3 Middle C

You can see in the diagram that each C is labeled on the left side.

In addition the letter-name C, there is a number. That number indications which C we are looking at. On a keyboard (depending on the size of the keyboard), we might have six or seven different C keys. We use these numbers to note which one we are looking at.

You can think of the numbers simply as identifying the range. High numbers (like C5 and C6) will be a high pitch, and low numbers (like C1, C0, or even C-1) will be low. To be more specific, these numbers are identifying the octave. We will be focusing on octaves in the next chapter, so for now - just think of that number as the range.

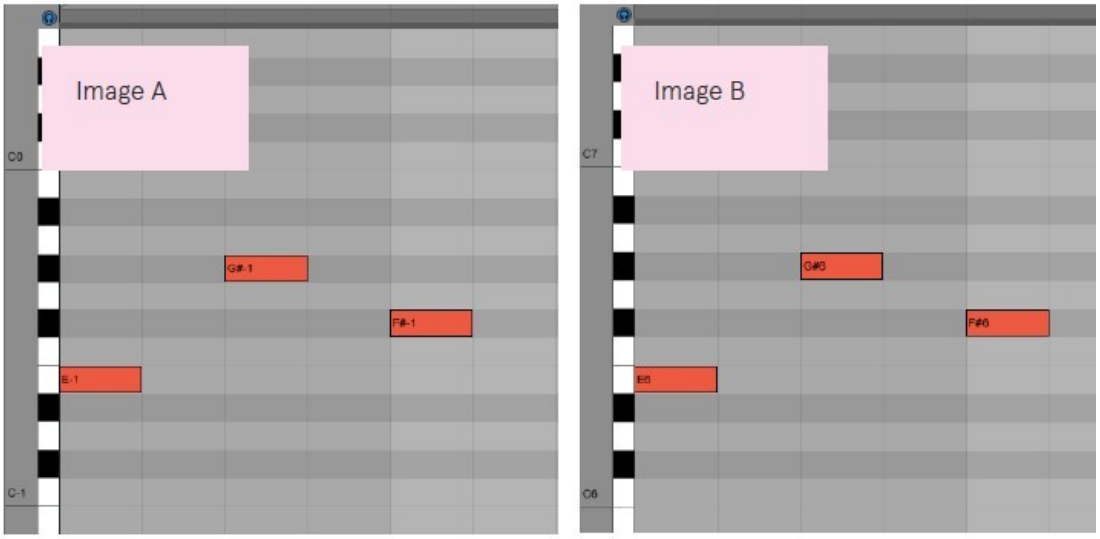
It is important to be able to identify one key in particular. Middle C is the C key that is right in the middle of the keyboard. Technically speaking, middle C is C4. If you look at the diagram above, you can see C4. However, there is some confusion about naming middle C in electronic music, and finding it can be difficult.

The first thing that makes middle C tricky is that as electronic musicians we are often working with less-than full size keyboards, which makes the "middle" subjective and moveable. Using an octave button, we can change our settings so that C4 is our lowest note on some keyboards. Secondly, there has been some confusion from synthesizer manufactures about middle C: Yamaha keyboards (and a few others) label middle C as C3, while Roland keyboards (and others) label it as C4. For the purposes of this book we will stick with C4.

3.4 Why Do We Care about Middle C?

You can think of middle C as a convenient "home base," which you can use when programming to identify where you are.

Look at the example images below. Both images are showing the same notes. What is the difference between them?



If you look closely, you will see that image A is extremely low. It is centered in between C -1 and C0. Image B has the same pitches, but way higher - between C6 and C7. Often when we are working with notes and inputing them into the piano roll editor, it is easy to loose track of the range of notes we are in. When we play these two segments, we are going to hear wildly different sounding things.

To avoid the problem of loosing track of what range we are working in, we can simply keep track of middle C. Looking at image A above: we should be able to see that C0 is near the top of our grid. That means that C4 is up higher - a lot higher. Which means we are working on a bass line. In image B, we would see C7 at the top of our grid, which would tell us we are higher than C4, so we are working on some kind of high melody or percussive effect.

To further explain those numbers, we need to start talking about Octaves. We've seen this word before - on our synthesizer, right next to the Semi knob.

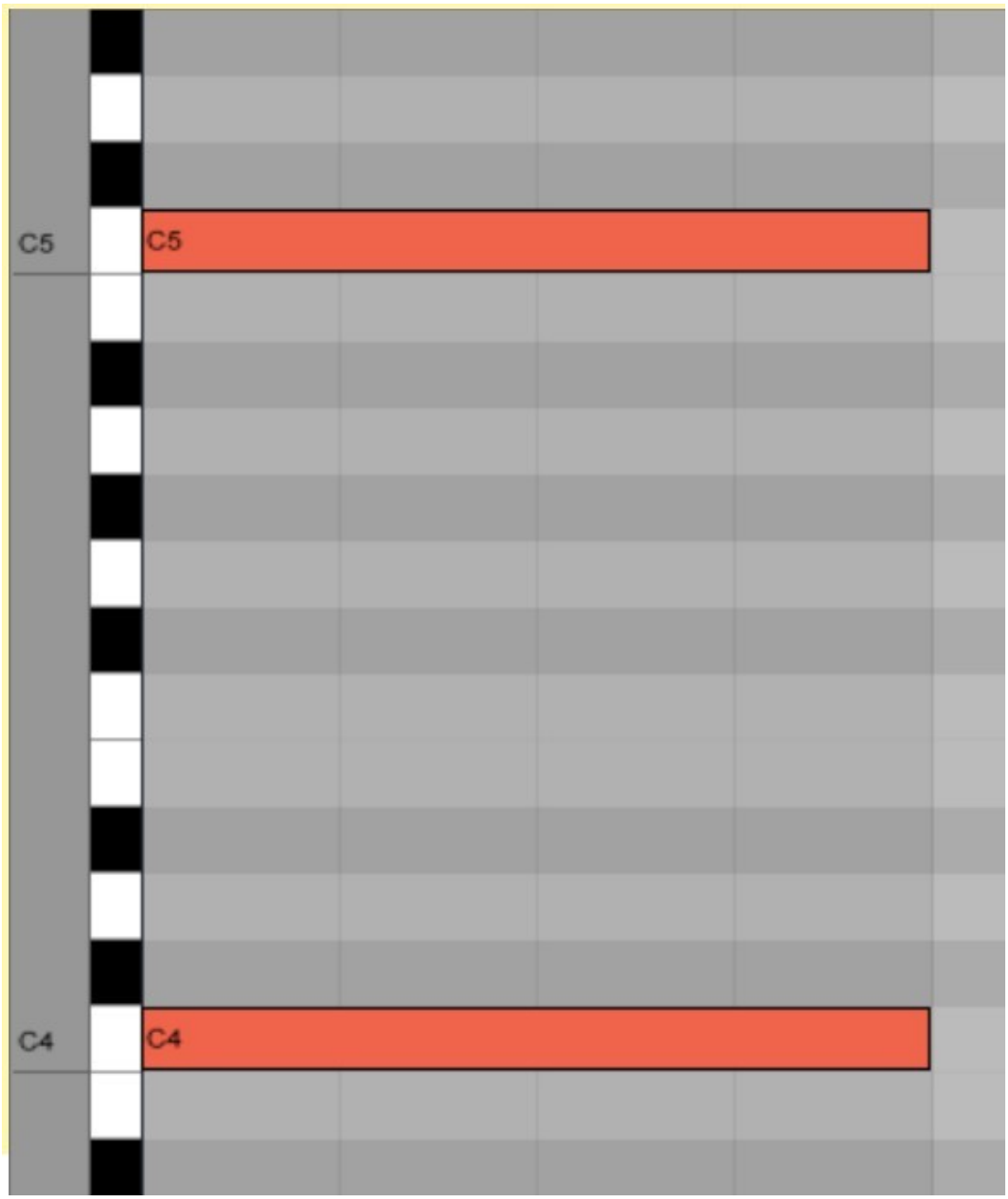
3.5 Let's Get a Little Technical

The pitch "Middle C," or C4, is not an arbitrary pitch. It is actually about 261.6 Hz. Maybe you've heard of the expression, "A 440". That means the pitch A (actually A5) is about 440 Hz. That is the A above middle C. Because "440" comes out to be an even number, we use it for tuning forks, and to tune acoustic instruments with. If you've ever heard an orchestra tuning, they are playing an A at 440Hz. [2]

> [2] In the United States, most orchestras tune to 440Hz, but some other countries tune to a different "A", like 444Hz. This makes them just a little bit higher in pitch. Some orchestras prefer that sound.

When it comes to working with our software, we can attach another number to middle C: 60. In MIDI, middle C is note number 60. This can be useful to know if you are trying to do a MIDI mapping of middle C. If you are using the Computer MIDI Keyboard, the letter A is middle C. ►

4. Octaves



4.1 What Are Octaves?

In the image above, we are looking at C4 and C5. These are octaves: the same note, but in a different register. What makes them the same? Why, in other words, don't we count up the whole alphabet? Why do we stop at G and start over again at A? That method of cycling through the first seven letters of the alphabet is what results in the repeated notes, and creates octaves. It isn't arbitrary though - there are some very good reasons why music works like this.

To begin, let's dive into the word Octave.

It's prefix, Octa-, means eight. As in octagon, octopus, octuplet, and octarchy[1], to name a few. Like these, Octave means a group of eight notes. If we count from C4 to C5, those eight notes would be:

C4, D4, E4, F4, G4, A5, B5, C5

[1] A form of government in which eight people govern all the people.

We only include notes that are in key when counting the notes of an octave. We haven't talked about what being in key means yet, so for now, just remember that the key of C is easy because it only includes the white notes. It doesn't have any modifier notes (sharps or flats) in it (I'll explain why this happens soon). Therefore, we will only count the white keys to get our eight notes that makes up the octave.

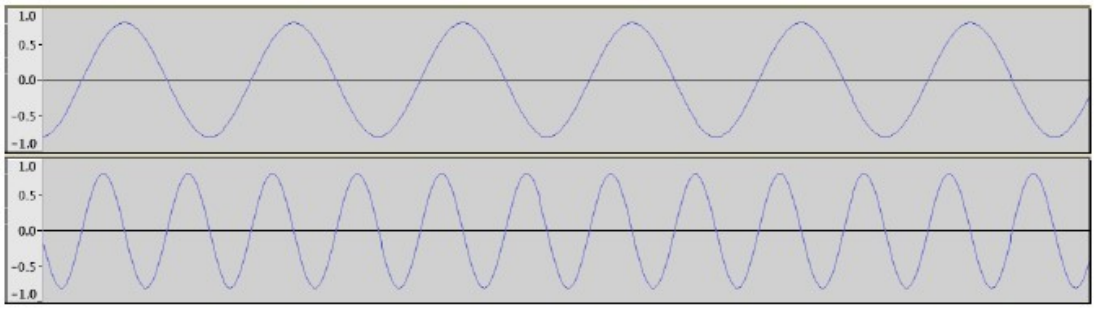
4.2 Sonic Similarities

There is more to the octave than just counting eight notes. Octaves have a sound to them. They sound like they fit together, and the reason for that is that an octave is always a 2:1 ratio.

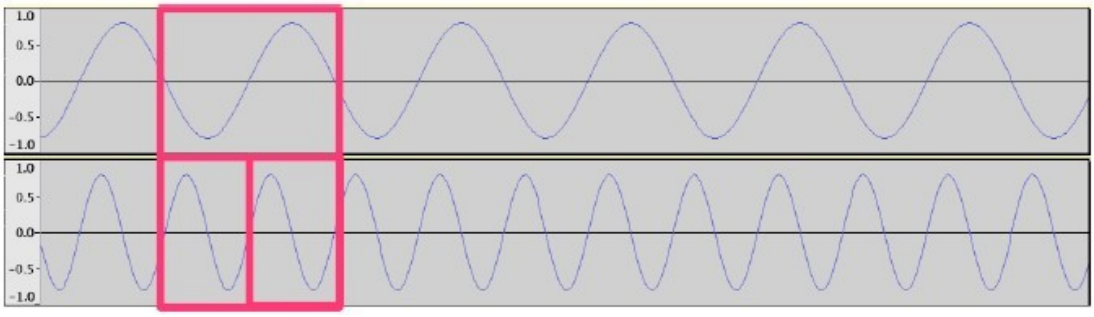
What Notes Sound Good Together?

Octaves will always sound good. If you are playing a riff, and want to beef it up, add an octave to all the notes. Or just some notes, if you like. Experimenting with octaves will never produce an ugly (or dissonant) sound.

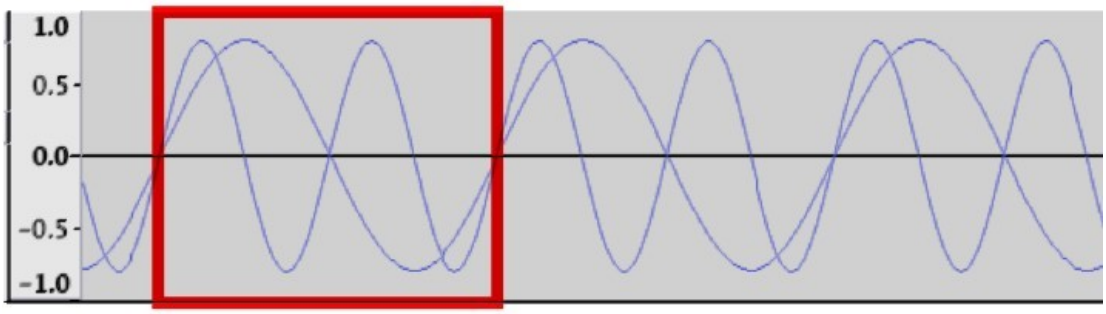
Looking at the waveforms of two pitches will give us another insight into why octaves work together.



In this diagram, we are looking at two audio signals. The top one is of middle C (C4). The lower signal is C5. For every cycle of the waveform that happens in C4, two cycles happen in C5. This is one of the characteristics of an octave. The higher octave waveform is twice as fast as the lower octave. If we went up to C6, it would be twice as fast as C5, and there would be four cycles of the waveform for every one cycle in C4.



This is significant because it means that the waveforms will fit perfectly inside of each other. In the graph below, you can trace two cycles of the upper octave (higher pitch) for every one cycle of the lower octave.



The business of ratios like this is very important in music theory, but is often left out of the discussion because it gets super technical rather quickly. Instead - we tend to focus on the results of those ratios. For instance: Instead of talking about the pleasurable sound of a 2:1 ratio, we talk about the pleasurable sound of Octaves.

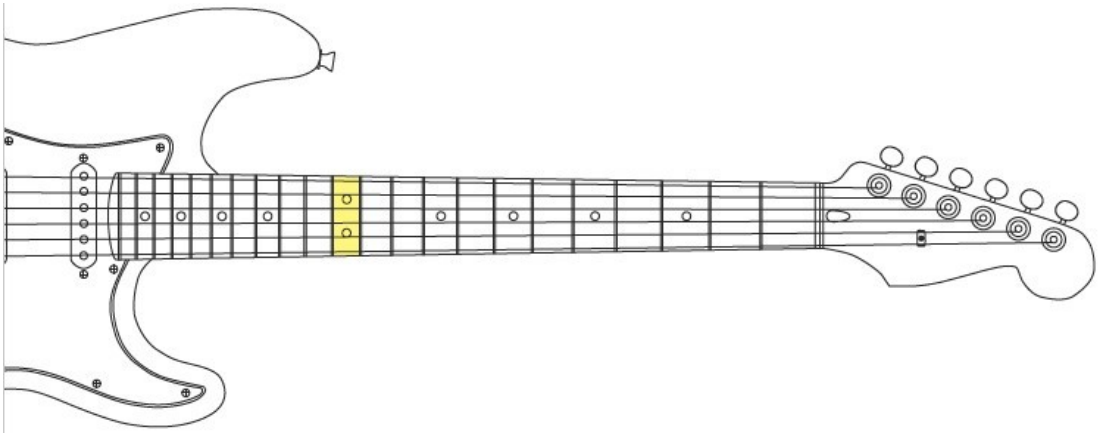
There are more - many more - ratios when we start talking about intervals. The thing to keep in mind is that "easy" ratios tend to sound good, and "odd" ratios tend to sound dissonant. We can loosely define "easy" ratios as ratios that when divided end in a whole number or close to it. For example: an octave, 2:1 (2 divided by 1 = 2) is a whole number, so it will sound good, while the ratio of 8:7 (8 divided by 7 = 1.14285714) will be a more dissonant sound.

4.3 The Ratios on a Guitar

Let's take one more look at the Octave, the 2:1 ratio, but this time on a guitar.

If you play guitar or not, it won't matter for this example. The guitar is a relatively simple way to demonstrate that the waveform of a higher octave is twice as fast as a lower octave.

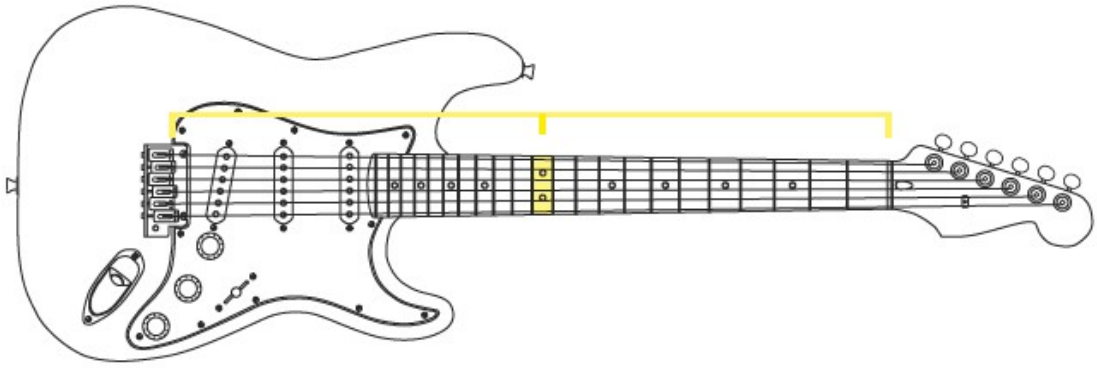
12th fret is marked in yellow



On almost any guitar, there is a special marking on the fretboard at the 12th fret. Usually, and in the case of this diagram it is two dots. This fret is one octave higher than any open string. For example: if you play the lowest string on the guitar "open" (without putting any fingers down), it will be an E3. If you put a finger on that string on the 12th fret and play the note, it will be an E4.

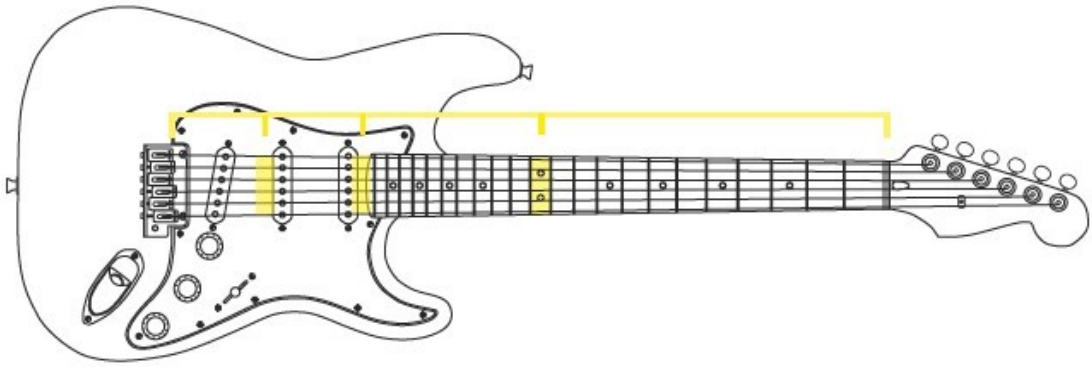
But why?

That point - that 12th fret - is actually the halfway point of the string. The open string is generating a wave form of a certain length and speed, and the 12th fret position generates a waveform exactly half the length. Thinking again about our ratios, if we call the open string 1, then the upper octave is 2. We get two octaves worth of notes for the one open string.



What if we want another octave higher? We can get it by treating the new octave as a 2:1 ratio, and finding the half way point of it. It is going to be a much smaller length (exactly half the length) so the notes in between are going to have to be squeezed together a little closer. This is why, when you look at the frets on a guitar, they get closer together as they get closer to the bridge.

From right to left, marked in yellow: 12th fret, 24th fret, 36th fret



Some guitars have a 24th fret, and some don't. Our example here doesn't have one, but you could find a second octave at approximately the half-way point between the 12th fret and the bridge. If you then divide that distance in half, you will have another octave, and so on.

4.4 Octave Key Points

Don't get stressed out about the math here: as a musician, you won't be calculating ratios while you are producing (or performing). The key concept here is that the waveforms fit together in smooth ways when the ratios line up to allow for it, and that produces more "consonant" sound. When the ratios do not allow for the waveforms to line up in systematic ways, it produces dissonant sounds.

The most important thing to remember from this chapter is that Octaves always sound good. Whenever you have a riff, pattern, or chord that you want to make "thicker", add an octave to it.

Also remember that if you have a riff, pattern, or chord, you can move the whole thing up or down an octave and it doesn't change what notes you are using. So if you think, "I like this riff but wish it was higher," just move it up an octave and you haven't changed any notes. ►

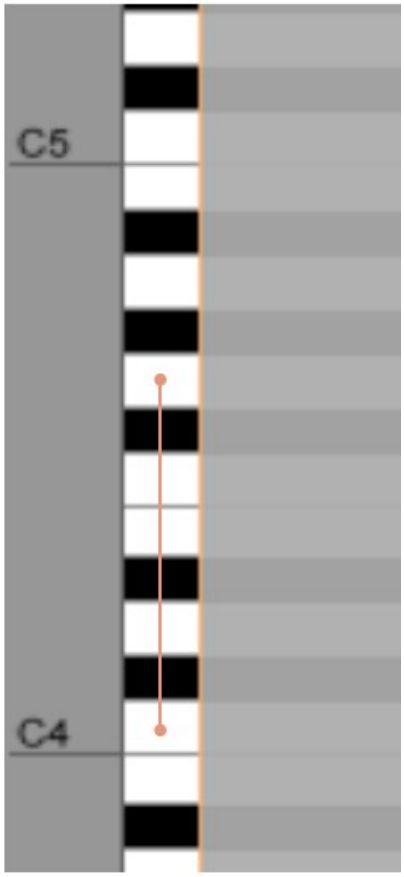
5. The Perfect 5th

What Are 5ths?

If octaves always sound good, perfect 5ths usually sound good. It depends on the context, and where you put them. We use them to sometimes make a sound feel "thicker." If you have a single note, but you want it to sound stronger, meatier, and more forceful, try putting a fifth on it. It won't always work in the same way that octaves will, but it is usually a fairly safe interval.

5.1 Finding a Perfect 5th

The bottom dot is a C, the top dot is a G. The line is the distance of a perfect 5th



To find the Perfect 5th of a note, you can count up five notes from another note staying in key. The key is important here, because if you count up five notes from any other note, you should land on a 5th of the original note, but not necessarily a perfect 5th.

If we stick to the key of C major (only the white notes), and we count up five notes from C, we land on G.

The pitch G is a perfect 5th above C. Since we are in the key of C, we call the pitch C the first note, then D, then E, then F, then G. That's five notes - a perfect 5th.

5.2 Why Are They "Perfect?"

We usually describe intervals by saying their name (5th) and their quality (perfect). Some intervals can have multiple qualities. For example, when we look at the interval of a 3rd third, we will find that the 3rd has two different qualities it can be: Major or Minor. From a technical perspective, the quality of an interval usually translates to how many half-steps are in it. A major 3rd is four half steps apart, and a minor 3rd is only three. We will talk more about this concept when we discuss 3rds, but just remember that these are called interval qualities.

Unlike 3rds, the interval of a 5th only has one quality [1]. You could say that it does not have the option of being major or minor - it is perfect just the way it is. The term perfect actually goes back about 400 years, and was used to tell us that the 5th was not allowed to be altered. You can change a 3rd from major to minor, but you can't change a 5th. It is perfect.

> [1] There are other qualities to 5ths, but they are not major or minor. If you get into advanced music theory, you will find augmented and diminished 5ths. In popular styles, however, they are rare.

5.3 What Do They Sound Like?

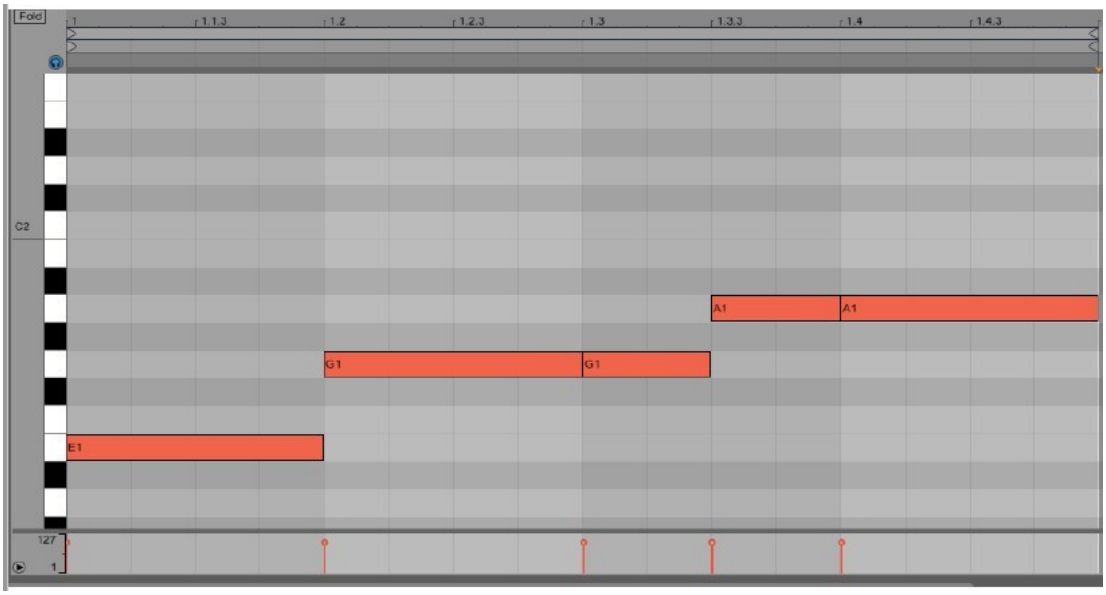
I always think of the sound of a perfect 5th as a "gritty" sound. It's a consonant sound, with no trace of dissonance, but if you use nothing but 5ths for an extended period it the sound will be a little off-putting. However, there are some context when we use a lot of perfect 5ths.

Power Chords: If you play guitar, you know what a power chord is. If you don't play guitar, all you really need to know is that a power chord is nothing more than perfect fifth in the lower register of the guitar. Just about every big-riff guitar sound is made up of a series of power chords. In this context, using a bunch of 5ths can be a great, aggressive, sound.

"Eastern" Sounds: As always, it is dangerous to lump styles of music into any particular culture. However, if you close your eyes and tried to imagine the most typical traditional eastern (think: China) sounds, you might end up hearing something with a lot of perfect 5ths in it.

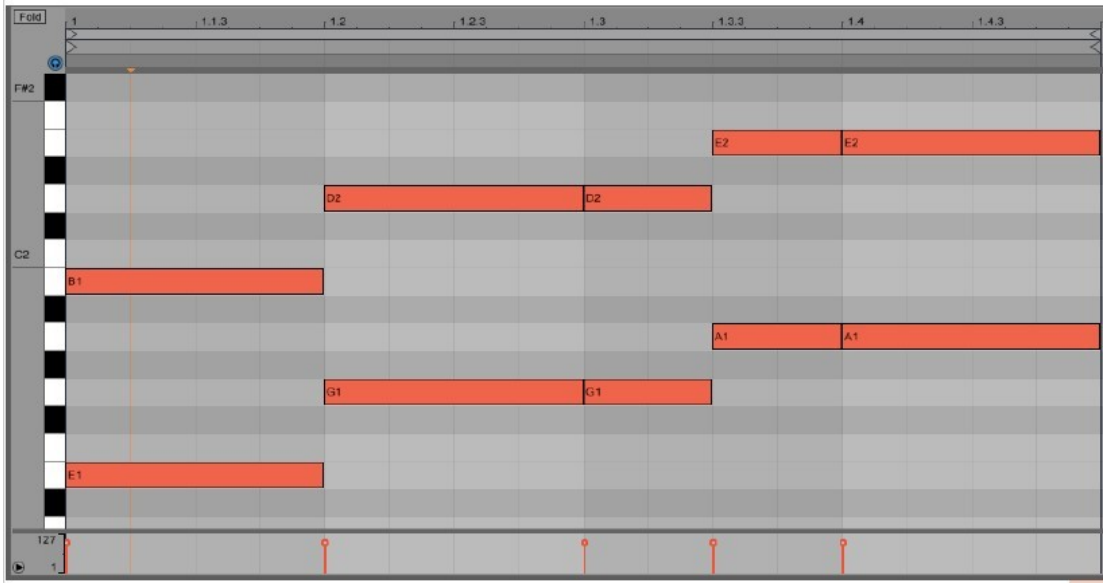
5.5 Try it - Power Chord Riff with Perfect 5ths

In your DAW, recreate the following pattern in the Piano Roll Editor. Don't forget to check the octave.



This is a simple pattern, reminiscent of a guitar power-chord style riff. In this case, we are only seeing the riff, without any octaves or 5ths. Listen to it with a simple synthesizer, or even a piano sound. Once you get a feeling for it, add a perfect 5th to all of the notes.

To find the 5th, just count up five white notes. The first note, E, up five notes becomes a B. The second note, G, becomes D, and the third note, A, becomes E. We add those notes to the original notes to make the interval of a perfect 5th on all notes. Your pattern should now look like this:

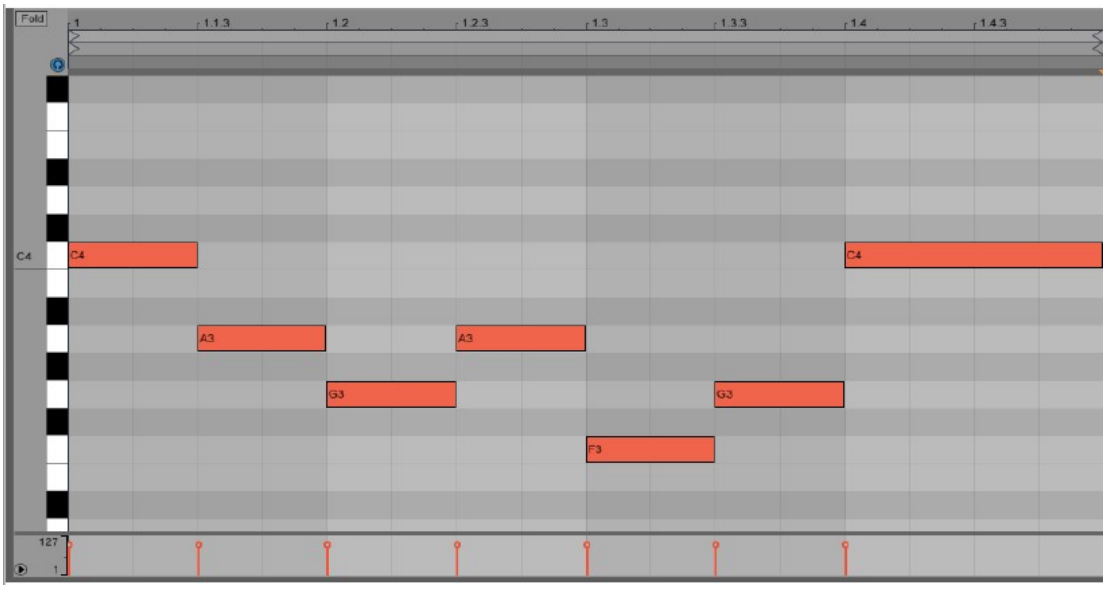


Listen to it again. Do you hear the difference? The pattern has a little more power to it, which is why we sometimes call this kind of a riff a "power chord" pattern.

Next, try moving the upper notes up even more to make them an octave higher than the original notes. Listen to the difference between the octave version and the fifth version.

5.6 Try it: Melody with Eastern Inflections

Create the following pattern in your editor. For this one, we will use a higher octave to achieve the effect of invoking "eastern" music.



This is a simple melody just using white notes. If we add a perfect 5th to all the notes, however, we can get that characteristic eastern sound with all the moving 5th intervals.

What we hear now is a sound that doesn't have the "power" of the previous example. It still has the grit and thicker sound of a 5th, though. In the upper octave the "power" is replaced with a sound we tend to associate with Chinese and other eastern music. ►


Fold
1
1.1.3
1.2
1.2.3
1.3
1.3.3
1.4
1.4.3
G4
G4
E4
E4
D4
D4
C4
C4
C4
A3
A3
G3
G3
F3
127
1

6. Being "In Key"

6.1 What Does it Mean to be "In Key?"

Think of the key as a process of elimination.

If we look at all our possible notes (the white keys and the black keys), there are 12 before they start repeating. Now take any given pitch - let's say F. Of those 12 notes, some of them are going to sound good with F, and some are not. If we use the key of F, we narrow down our possible notes to only eight. And all eight of those notes are going to sound pretty good with the F. The four that we got rid of can be called "not in key" - we can still use them if we want, but they will be out of key, and trickier to make sound good against our original pitch, F.

In this example, we would call F the "root", the eight notes that sound good with F is the "key," and if we put all those notes in order, it would be a "scale."

6.2 The Elements of a Key

First, let's separate out three different terms we are going to encounter a lot in this book: key, scale, and chord.

The Key is the pattern of notes that work together. While there are 12 possible notes you can play (in a single octave), only eight of them are in key and therefore are the best notes to use. In fact, you can think of a key as a way of eliminating notes that won't sound good. If you start with a single note, say, C, then the key will tell you seven more notes that will sound good with that note.

A Scale is an arrangement of all the notes in a key. The key it'self just tells us what notes will sound good together, a scale is all of those notes in a given order: either from low to high or from high to low.

A Chord is a smaller grouping of notes within a key. Chords usually have three or four notes in them, all of which will be in the key (if our chord progression fit's entirely in the key, which is an option we have. More on this later). A chord is made of notes in key that sound especially good together. So while all notes in the key sound relatively good together, the notes in the chord work really well when grouped.

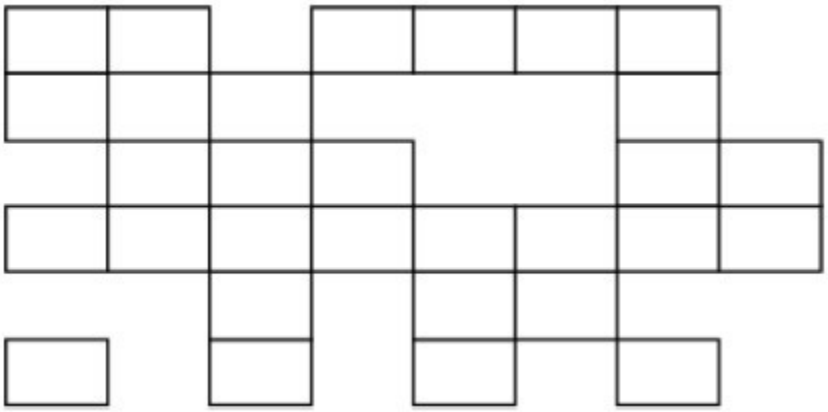
To Sum Up:

Keys are all the notes that sound good together. Scales are all the notes of a key in order, and chords are smaller groupings of notes that sound especially good together.

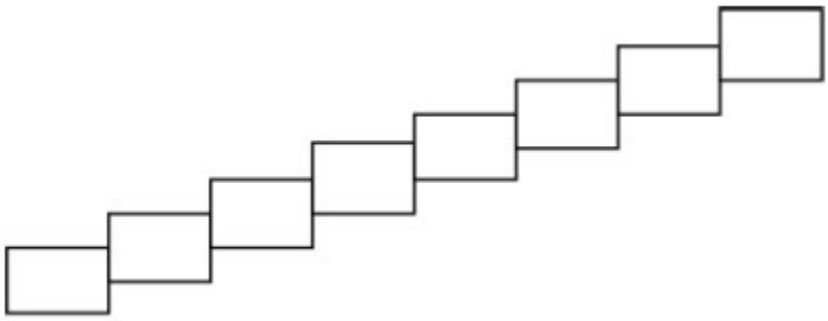
Think of these three things in terms of toy building blocks. If you dump all the blocks you want to use out onto the floor:

- Separate out all the red blocks. That is your Key.
- Now put the red blocks in order from biggest to smallest. That is your Scale.
- Now build a few small things with the red blocks. Those are your chords.

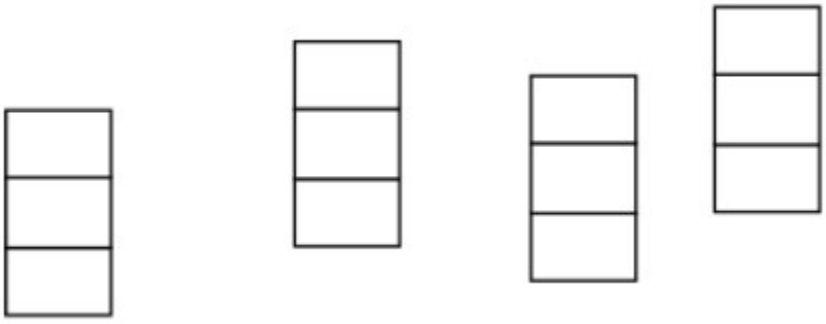
Key



Scale



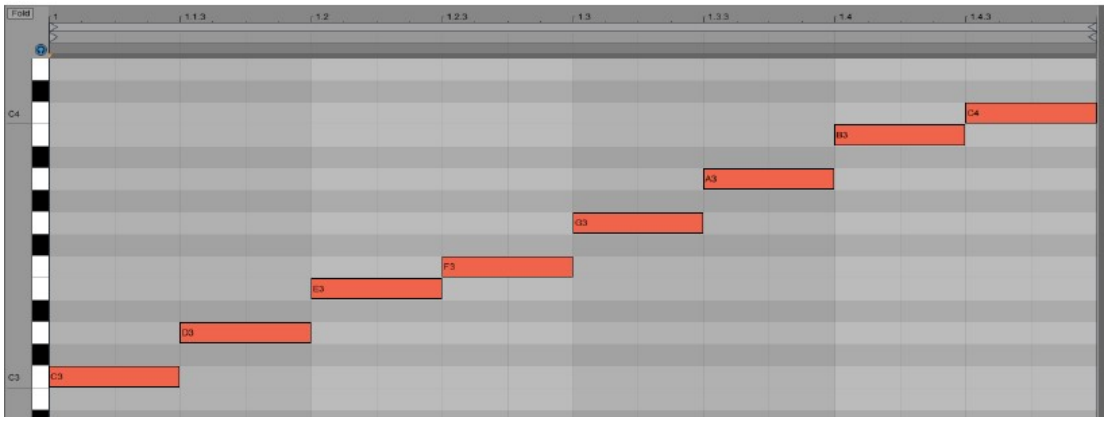
Chord



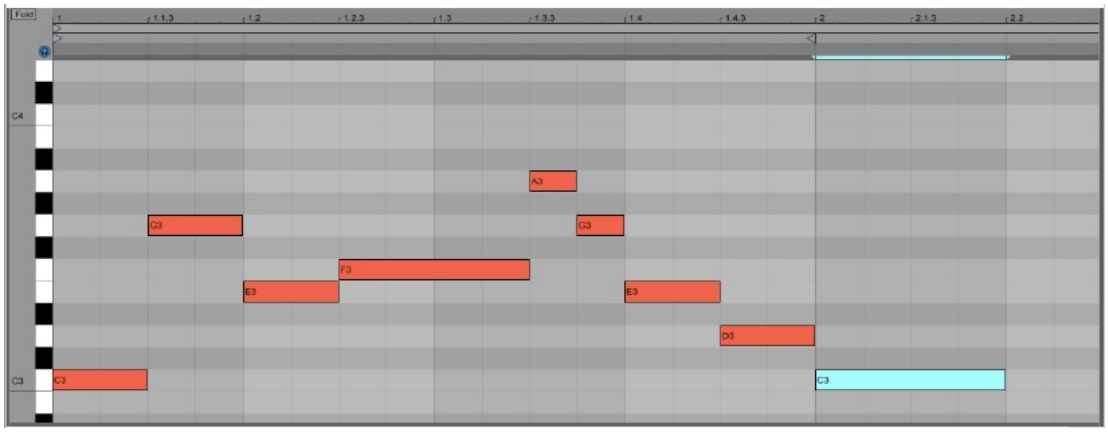
6.3 The Key as a Template

When we are writing music, the key becomes a template: it tells us which notes are "safe" and which notes are not safe. With some practice, you can begin to learn which notes within the key will sound best in any situation without too much guesswork.

Let's look at an example: This is the key of C Major:



In the next section we will learn how to determine what notes go in a key, but for now, let's just treat this pattern as a template. You can see here that this pattern starts and ends on the pitch C, and it has only white-notes on they piano roll in it. I've put them in order, so what we are actually seeing here is a C Major scale.



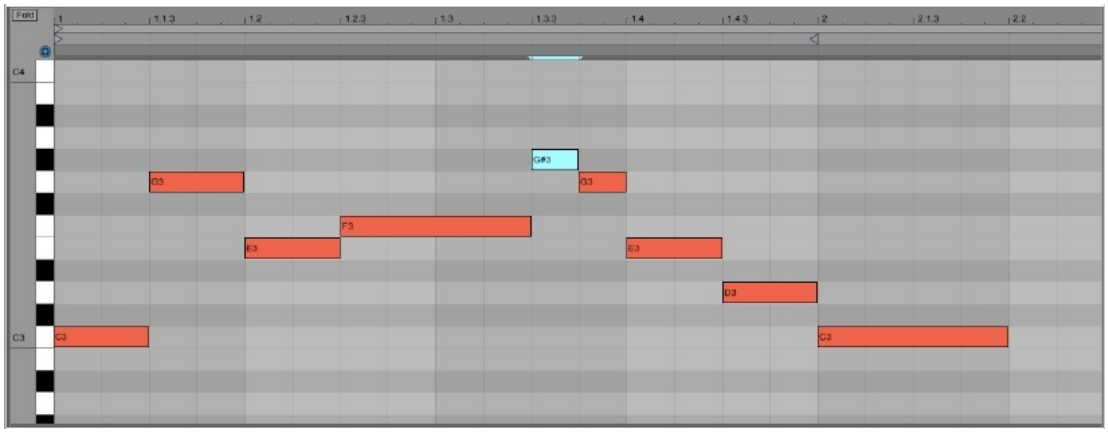
If we just play around with the order and rhythms of those notes, but we don't add any notes that are not in that pattern, we might end up with a

melody like this: What I did here is use the notes from the scale, but I just changed the order they happen in to something that sounds relatively nice. I can look at this and know that it will sound nice, because all of the notes are in C Major. I didn't add any notes not in the key. I've just rearranged them into something that feels good to me.

If we break the template, and use a note that is outside of the key, we end up in dangerous waters.

Look at the fifth note in this example:

In the first melody example the fifth note was an A. Now I've changed the note to G#. This note is not in the template from the C major scale we saw earlier, so this note is out of key. It will not sound good in this example.



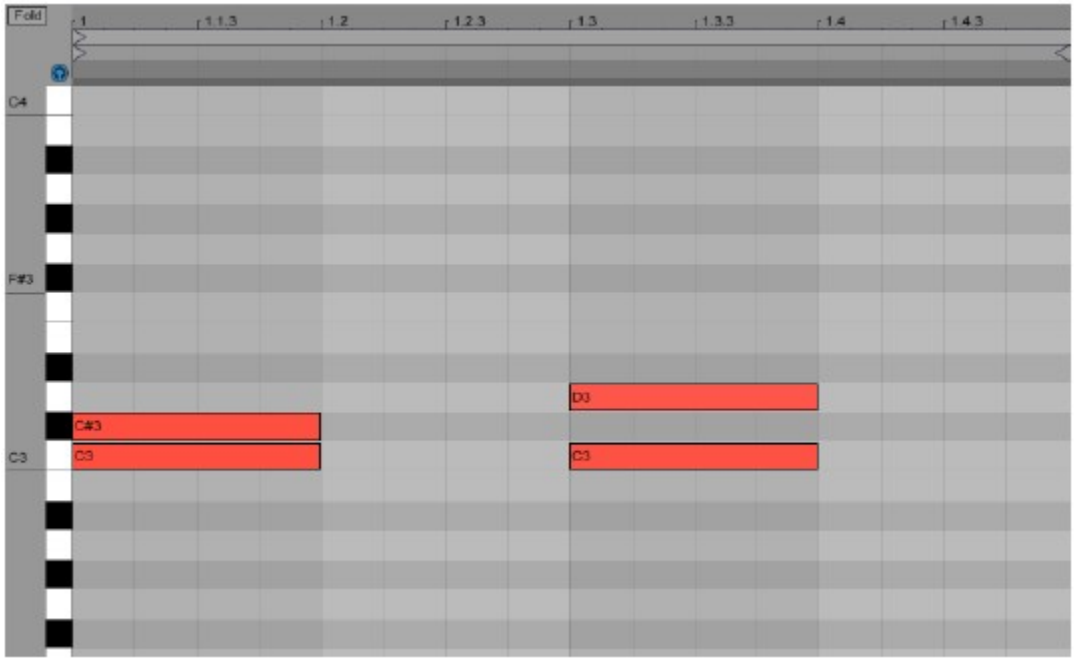
Should you always stay in key?
No! I like to use the term "safe" for notes that are in key, and "less safe" for notes that are not in key. If you only use the safe notes, your music will sound nice, but it will never have uniqueness, or anything compelling in it. The key is a pattern that tells us what notes will sound good, but some notes outside of the key sound great. It is always healthy to explore notes outside of the key.

6.4 Half-Steps and Whole Steps in Keys

In chapter 2 we talked about semi-tones and whole-tones in terms of a synthesizer. Recall that we also referred to those notes on the Piano Roll Editor in slightly different term. Half-steps and whole-steps.

The distance of a half-step is the smallest amount of space between two notes. The distance of a whole step is two half steps. So on our Piano Roll Editor, two notes that are right on top of each other are half steps, and two notes with a space in-between are whole-steps.

Notes on the left are Half Steps, notes on the right are Whole steps



We can learn how to find any key through a pattern of whole steps and half steps that make up the scale, which will tell us all the notes in the key.

6.5 The Pattern of a Key

I like to focus on music theory as something that lives and breathes, and isn't just rote memorization. However, there are very few things in this book that I will point out as something that you absolutely need to memorize. This is one of them. You can find any key by starting on a root, and applying a pattern.

The root is the note that the key is named after. The root of the key of C Major is the pitch C. The root of the C Major scale is the pitch C. The root of a C Major chord is the pitch C. The root is always a single note.

Scale, Key, or Chord	Root (Single Pitch)
D Major Scale	D
D Minor Scale	D
G Minor Chord	G
Key of B Major	B
F# Minor Scale	F#
Key of G# Major	G#

To find the note in any key, we always start with the root. After we have the root, we can apply a pattern made of half-steps and whole-steps. This pattern is simply called the major scale. Once we've figured out the major scale, we will know all the notes in they key.

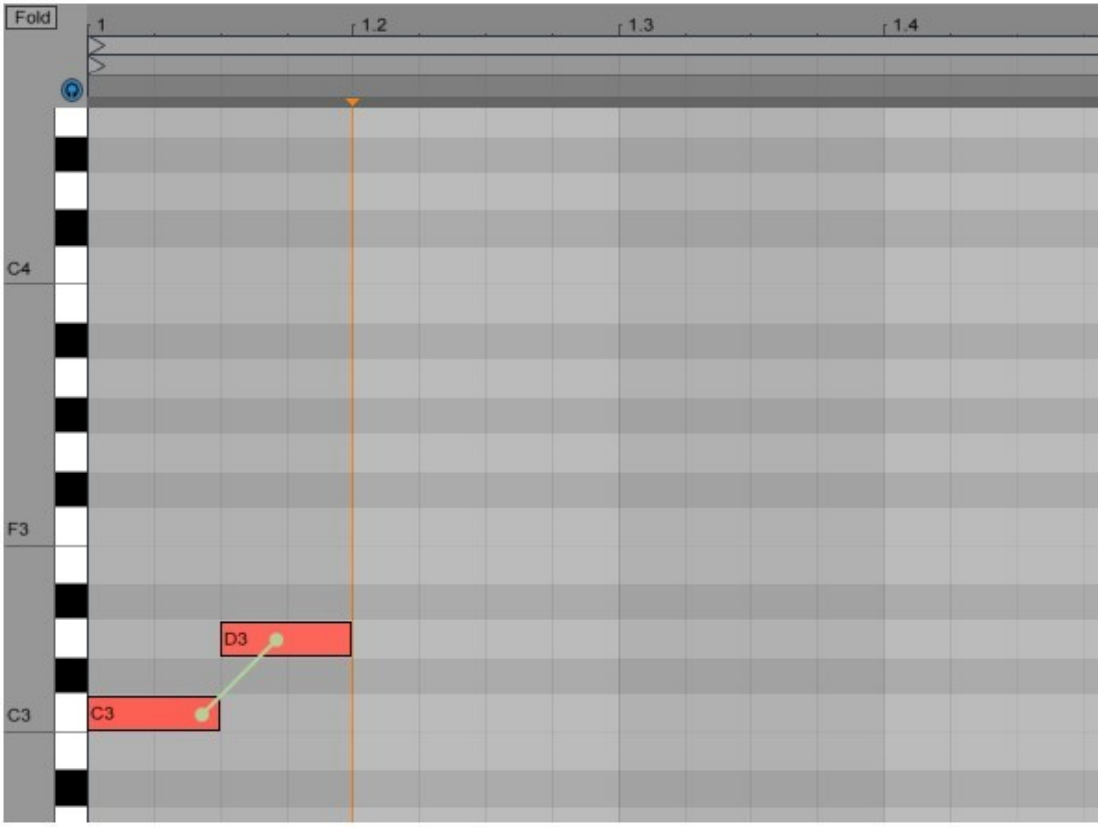
The pattern is:

W W H W W W H

In this pattern, 'W' refers to Whole-Step and 'H' refers to Half-Step.

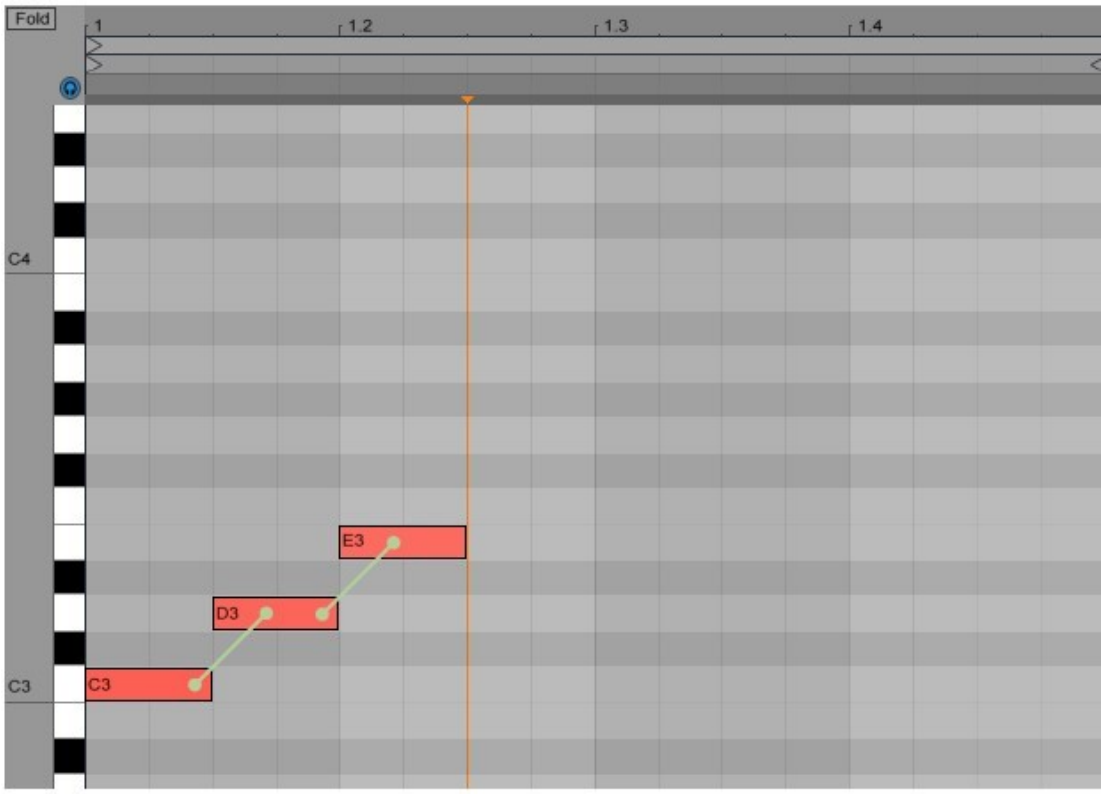
Let's say we want to find all the notes in C major. To do that, we will make a C Major scale. We start with the root (C), and following the pattern, our second note will be a Whole-step away from the root.

The green line shows the distance of a whole step



That puts us on the pitch D. Our next note will be another Whole-Step, but this time it will be a whole-step above D, landing us on the pitch E.

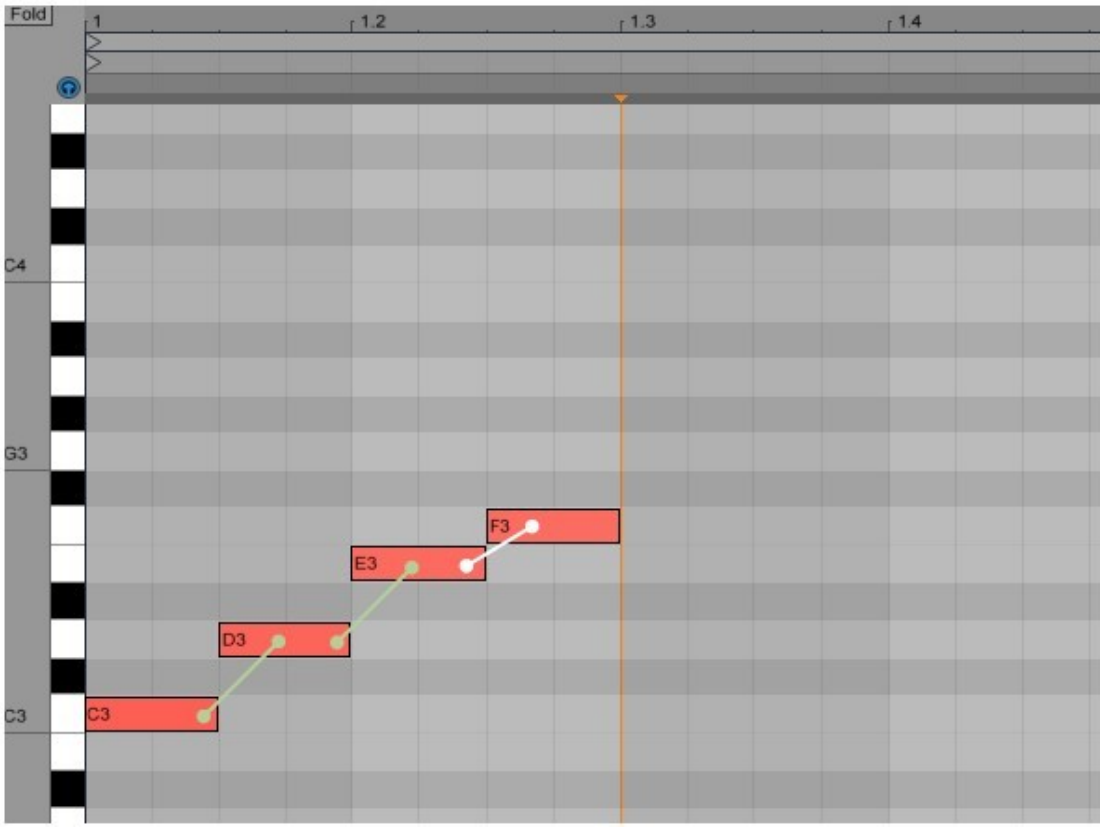
Whole steps are marked in green



The next note will only be a Half-step above the E. That puts us on an F.

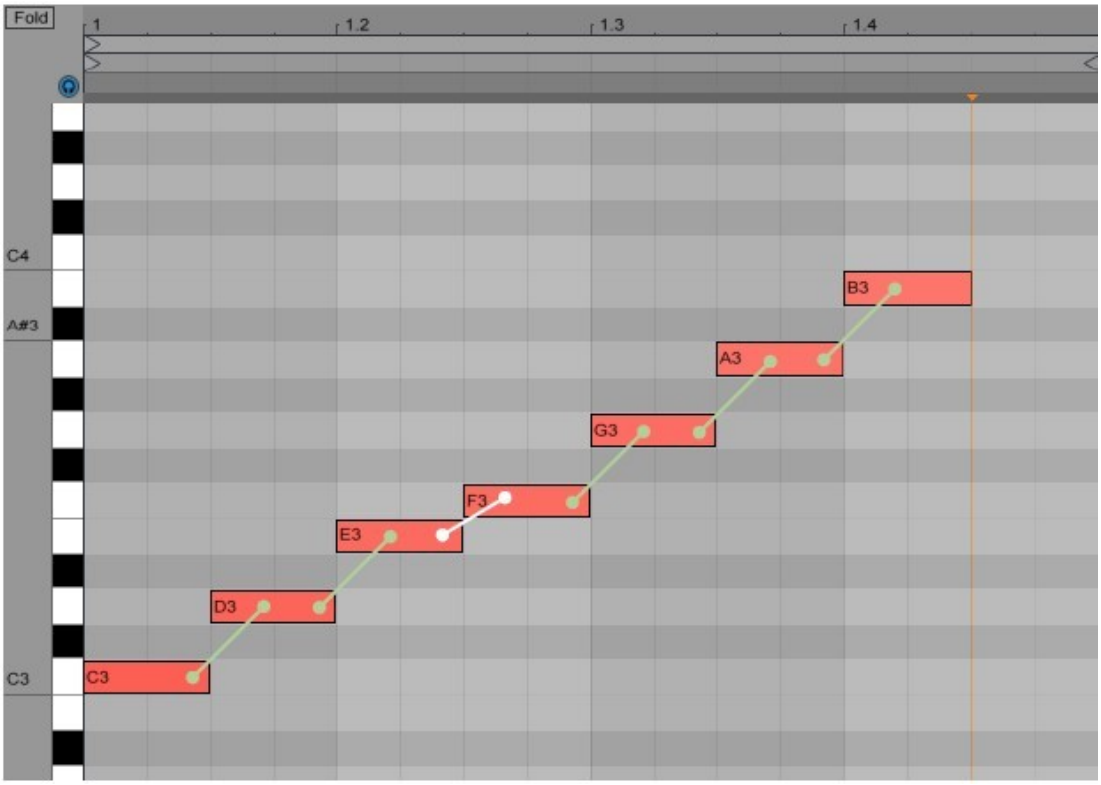
Remember that a Half Step will be the closest possible notes together, so on the piano roll editor it will be right above the previous note.

Whole steps are marked in green, Half step is marked in white



From here, we need three more whole steps, so let's add those.

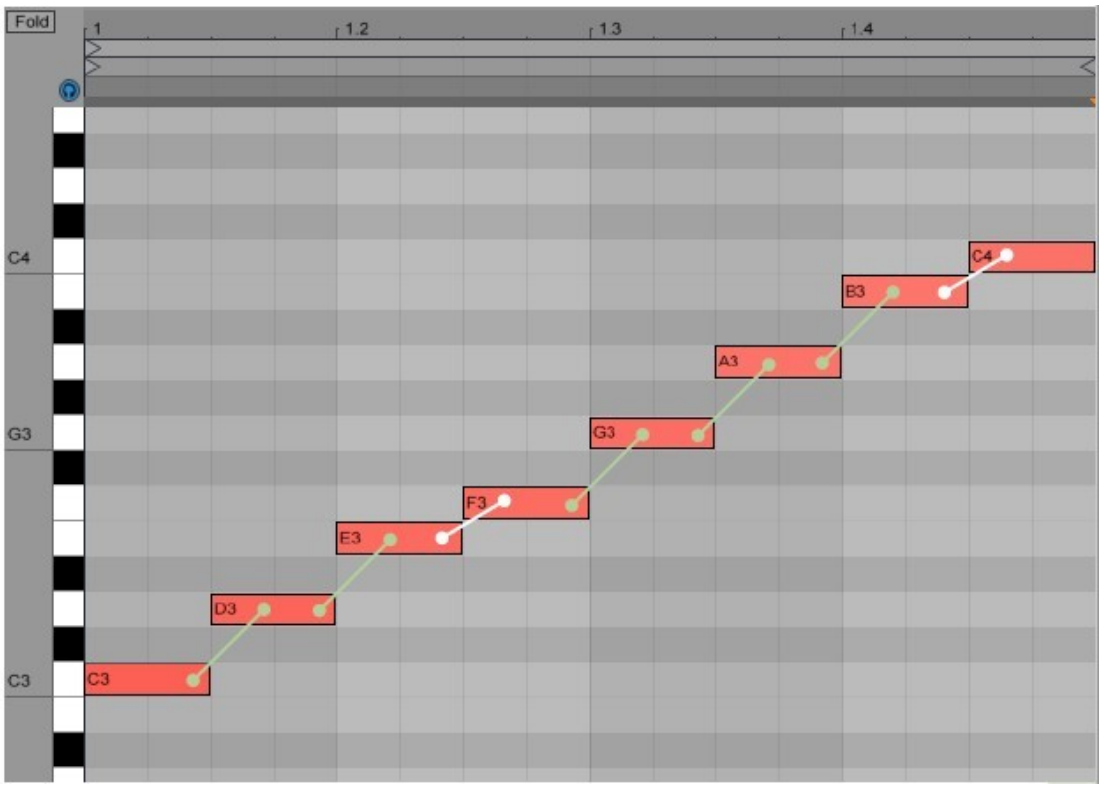
Whole steps are marked in green, Half step is marked in white



Lastly we have a Half-step at the end. And now we have the complete C Major scale.

Notice that the beginning and ending notes are the same note (the root - in this case, C), but an octave apart.

Whole steps are marked in green, Half steps are marked in white



At the start of this chapter we talked about three different elements: Keys, Scales, and Chords. We've learned how to find the scale, and that the scale will tell us all the notes in the key. We still need to learn how to find the chords, which is a huge part of music theory. Before we do that, however, we need to explore a little bit about how scales work, and practice using the Major Scale pattern a little bit. We will do both of these things in the next chapter. ►

7. Major Scales and Major Keys

We have two main types of scales and keys: Major and Minor. Think of these like two different flavors of ice cream: you might want chocolate ice cream, but you could get chocolate with peanuts in it, or chocolate with raspberries in it. Both are still chocolate ice cream, but they are going to taste very different. Major and minor scales work similarly: C major and C minor are both scales built around C, but they sound very different. For now we are going to focus on major scales and keys. It is important to note that this doesn't include chords: Even though we are in a major key, we still have major and minor chords that can be played. More on that soon.

As we go forward we are going to be talking about "scale degrees" quite a bit, so let's define what that means. The "Scale Degree" is a term referring to the relationship between a note and a root. For example, in a C major scale, the pitch D is scale degree 2. It's the second note of the scale. Scale degree 3 is E - it's the third note of the scale, and so on.

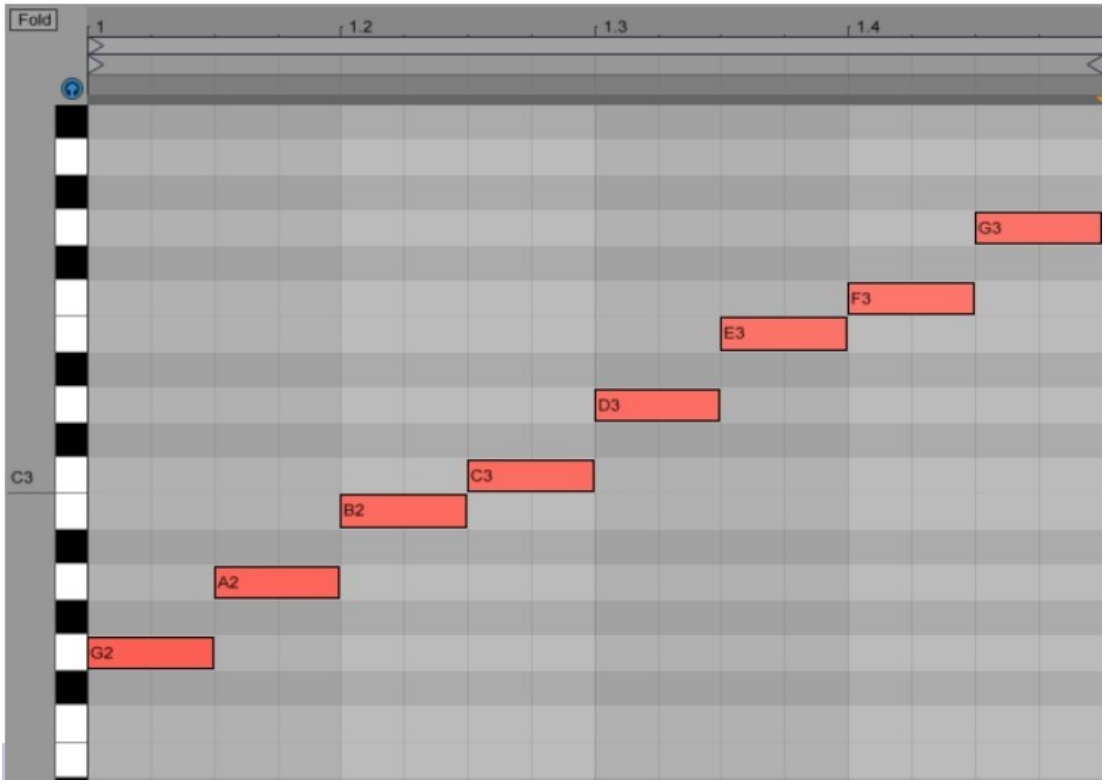
In a scale, we have seven notes different notes. Scales are often written with eight notes, where the first and

last are an octave apart. Each note of the scale has some properties that are important to keep in mind. We've already learned about the root of the scale - the note that it is named after. In the next section I want to look at the different scale degrees and their properties.

7.1 The Root

Scale degree 1 is also called the Root. We've learned a little bit about the Root already: we know that it is the note the scale is named after, and it is the lowest note in a scale if all the notes follow the pattern that we learned in the previous chapter. But what if they don't? In actual music you very rarely have scales written out in order from beginning to end. For example: what is the root note of the following scale?

To figure this out, let's try the W-W-H-W-W-W-H pattern. If this is a major scale (which it is) that pattern will be in there somewhere.



Starting on G, the first note here, the pattern that emerges is: W-W-H-W-W-W-H-W. Close, but not the right pattern.

Starting on A, the second note here, the pattern that emerges is: W-H-W-W-H-W-W-W (We have to circle around at the end to include the first note again, since we started on the second note, in order to make seven intervals). Not quite the right pattern.

Starting on B: H-W-W-H-W-W-W. Swing and a miss.

Starting on C: W-W-H-W-W-W-H. Bingo.

So even though this scale starts on a G, the root is C. This is a C major scale, it's just written from the pitch G to G. If we find our pattern in it, we will find that the only way that it works is if we treat C as the root.

The root note has another property as well: the root is "home". It always feels like a good place to end a melody. If you are writing something and want it to feel like it's over, go to the root. That will feel like we've returned back to where we started.

7.2 Try it

The analogy of the root as "home" is a common music theory analogy. Try playing the following melody and see what you think. This melody does not have the root at the end. It should feel like you are missing something.

There is something a little frustrating about how that melody ends. Your brain really wants to hear the root note at the end of it, but instead you are left someplace else.

Let's put the root at the end of it, and let our ears be satisfied.

Now that we have the root at the end of the melody, we are much more comfortable with it. We can now say that the melody has "resolved."

Do my melodies always need to resolve with the root note? No! Many melodies don't. If you want your melody to sound nice and predictable, make sure it starts and ends with the root. But if you want something other than that, it is perfectly ok to not start or end with a root. Remember that you are the producer and you can do whatever sounds best to you.

7.3 Supertonic: The 2nd Scale Degree

For each scale degree we can call them by their number or by their more music-theoryesque name. The second scale degree also has the name "supertonic". In this book we are primarily going to use numbers when we talk about scale degrees, but it's worth looking at these other names because they do shed some light on the properties of the scale degree.

This one, however, is a little misleading. The second scale degree is not called Supertonic because it is more powerful than the tonic in terms of it's feeling of "home". Think of Supertonic as meaning, "it super wants to go to the tonic." The second scale degree has a tendency to lead to tonic. If you end a melody on it, it will have a sense that it is unfinished because it is pulling you into tonic.

Look again at the incomplete melody I gave you earlier:

In this case we are ending on the pitch D, the second scale degree, the supertonic. Because of that it really wants to lead to tonic, and gives the melody a very strong sense of incompleteness.

7.4 The Mediant: The 3rd Third Scale Degree

The third scale degree is also called the Mediant, primarily because it is half way between the root and the fifth. The mediant becomes an extremely powerful note when we are distinguishing between major and minor scales. It is the first note that is different in a minor scale, and usually the most important at helping us to identify if the scale is major or minor.

7.5 The Subdominant: The 4th Scale Degree

The subdominant, or fourth scale degree, is typically one of our "perfect" intervals. Despite this, it has an interesting history of being treated as dissonant in some periods of time, and a consonant in others. Generally it works as a consonance to us.

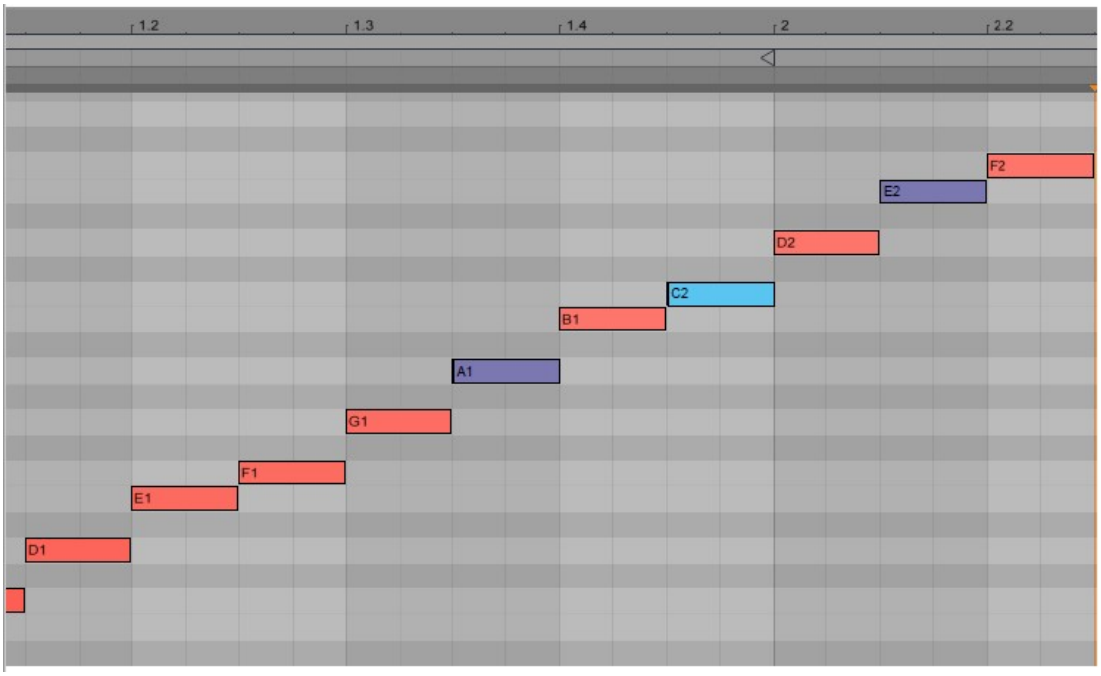
7.6 The Dominant: The 5th Scale Degree

The fifth scale degree is so named because it is the most dominant sonority in the scale, other than the tonic. In a major or minor scale it is a perfect interval, and it nearly always pushes us towards the tonic. Think of it like a swimming pool: if tonic is the pool, then dominant is the diving board. Once you get to it, it is a pretty safe bet that you will be landing in the pool pretty soon.

7.7 The Submediant: The 6th Scale Degree

The name "submediant" can be a little deceptive. If the mediant is the third scale degree, and if "sub" typically means "under", how can the sixth be the submediant? Remember that mediant refers to a scale degree half-way between the root and fifth. If you start on the root, but go down to the fifth, the half way point is the sixth - or submediant.

Blue notes from left to right are: A1 — Submediant, C2 — Root, E2 — Mediant

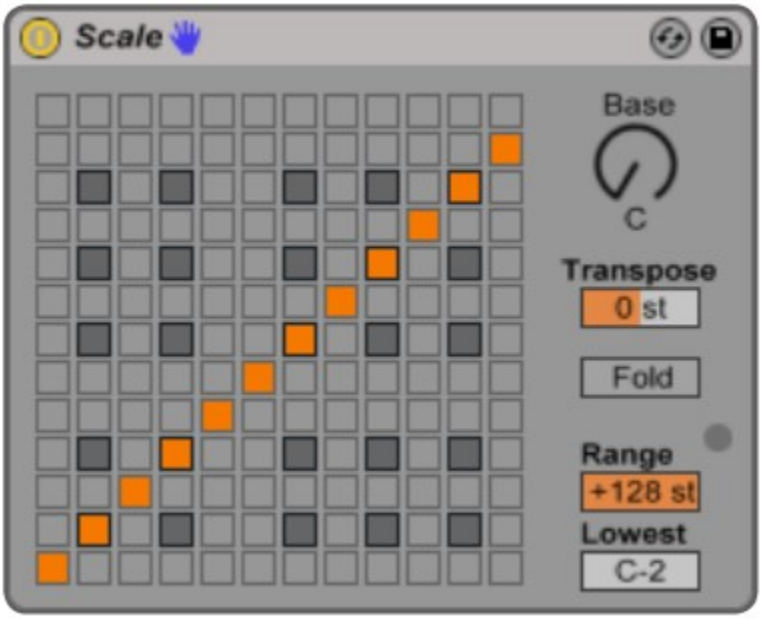


7.8 The Leading Tone: The 7th Scale Degree

We call this one the "leading tone" because it has a very forceful nature to lead us back to tonic, not unlike the dominant. The leading tone is one scale degree under the tonic, so it has a way of "leading" back to tonic.

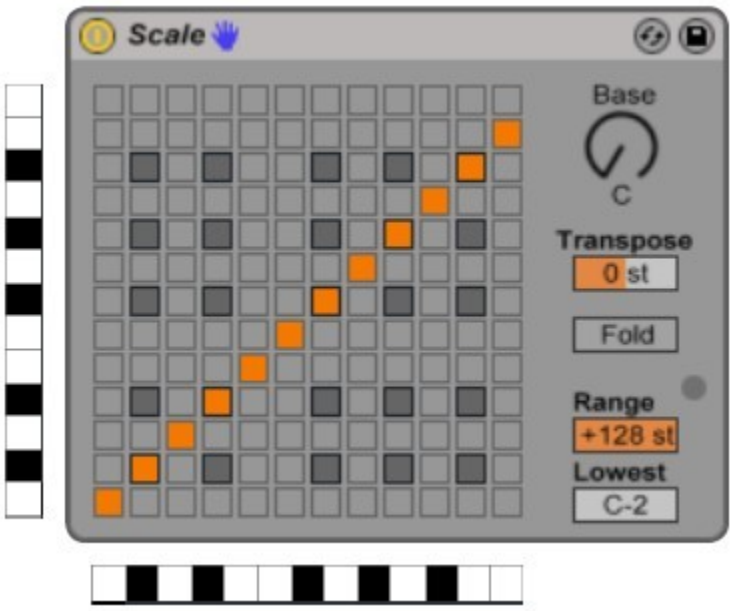
7.9 The Ableton Live Scale Device

In Ableton Live, we have a device called Scale. This device can quantize what we are doing into any scale. Now that we know a bit about how scales work, let's take a look at the device and shed some light on it.



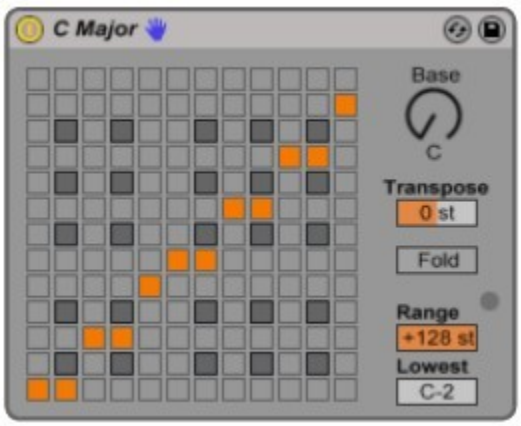
Imagine with this device you are looking at all the notes of a key along the bottom of the grid. Let's call those our "input" notes - or the notes that we play. On the right side, those are all the notes that are being output. The notes that have been changed by the device.

On the left are the notes we will hear, at the bottom are the notes we played



Notice how there are 12 steps - 12 orange boxes - in the grid. Each one of those represents a MIDI note in the chromatic scale - all possible notes. By default, when we play a note, the same note comes out. Look at the very first orange box in the bottom left corner. The pitch is C on the bottom, and the pitch is C on the side. So when we play a C, a C comes out. Going up the grid of orange notes, you will see that all of them align on both grids. Any note coming in is the same note coming out. This is the default state of the Scale device. It is essentially doing nothing.

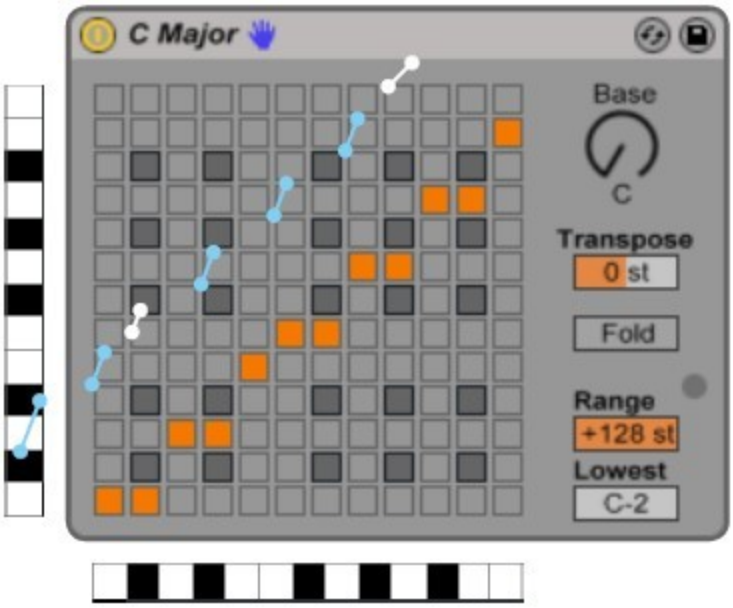
Now let's load up a scale. The C Major scale.



If you look at this closely you will be able to find the pattern of half-steps and whole steps we discussed in the previous chapter. When we play a C, a

C still comes out. That one isn't changed. But look at the second orange box: when we play a C#, still a C comes out. So this device is going to stop all C#'s from coming out, and replace then with Cs. If we keep working up the pattern you will see that only notes in the key of C are going to be let through. All other notes are adjusted to fit into the key.

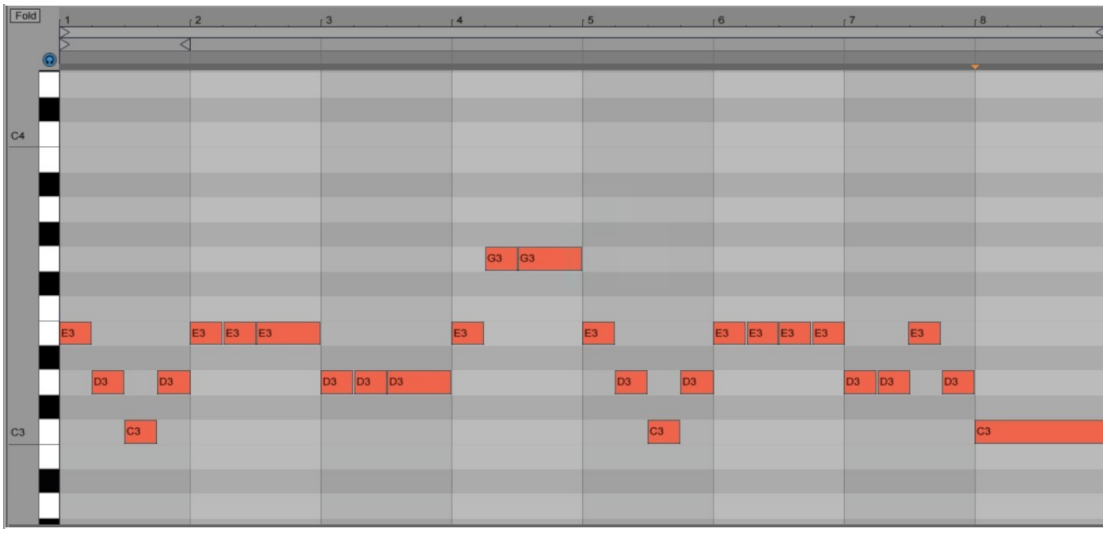
Whole steps are marked with in blue, Half steps are marked in white



The pattern of the scale is in there: It is alternating whole-steps and half-steps all the way up. There should be a half-step at the top, but the scale pattern ends before repeating the final C, so we don't see it. It's there - just not on the grid.

7.10 Song Analysis

Let's look at a song and see if we can figure out what scale it is using. For this one, let's start with something simple: Mary Had A Little Lamb.



When you are looking at a melody like this, there are a few clues in determining the scale that is being used. The first thing to look for is what the first and last notes are. If they are the same, it is likely (but not a sure thing) that that note is the root of your key. In this case, they are not: The first note is an E and the last note is a C.

Let's list all the notes used in this melody, leaving out repeated notes. The notes used are:

E - D - C - G

That's it. Just those four notes. Next, let's put them in order from low to high:

C - D - E - G

Next, let's try to build a major scale on each of those notes, by guess the missing notes. If we start on C, and do our WWHWWWH pattern, we would end up with: C - D - E - F - G - A - B - C. That hit's all of the notes in the melody, so that would be a pretty great guess. Just for fun, let's try

D: D - E - F# - G - A - B - C# - D. That couldn't work because our melody has a C natural in it - not a C#. The F# doesn't really throw us off, because there is no F natural in the melody. The F of the scale isn't in the melody, so it could be F natural or F sharp. We don't know. But we do know what the C is - it is C natural, but the key of D major needs to have a C# in it. So this can not be in D major.

Let's try E: E - F# - G# - A - B - C# - D# - E.

We can rule out E. This cannot be in the key of E major because it would need to have a C# in it (our melody has a C natural), a D# (our melody has a D natural), and G# (our melody has a G natural.) So E Major can not possibly be the key.

Let's try G: G - A - B - C - D - E - F# - G.

The key of G major is a possibility. It doesn't give us any wrong notes. Again - the F# doesn't throw us off because we don't know what the F of the scale is, because it isn't in the melody.

Remember that when a note is "natural" it has no sharp or flat. We can say a note is "C-natural" (meaning the white key).

So now we know this melody is probably in the key of C major or G major. How do we decide?

Two possible techniques will get you to the right answer. First, you could start to experiment, and listen. Play Mary Had a Little Lamb, and improvise on it. Throw in a F natural here and there and see how it sounds. Does it sound like it fit's? Now throw in an F#. Does that fit better or worse than the F natural? Remember that the difference between C major and G major is really just that F#/F natural. So if one sounds better than the other, it probably tells us the key.

A slightly more scientific solution would be to look at the chords. Once you understand how chords are built, you will notice that the melody outlines a C major chord. Since the melody gives us such a pronounced C major chord, it is the most likely key. (And it is, in fact, the right answer in

this case). So - we need to learn a little bit about how chords are made. Which is the topic of the next chapter. ►

8. The Basic Triad

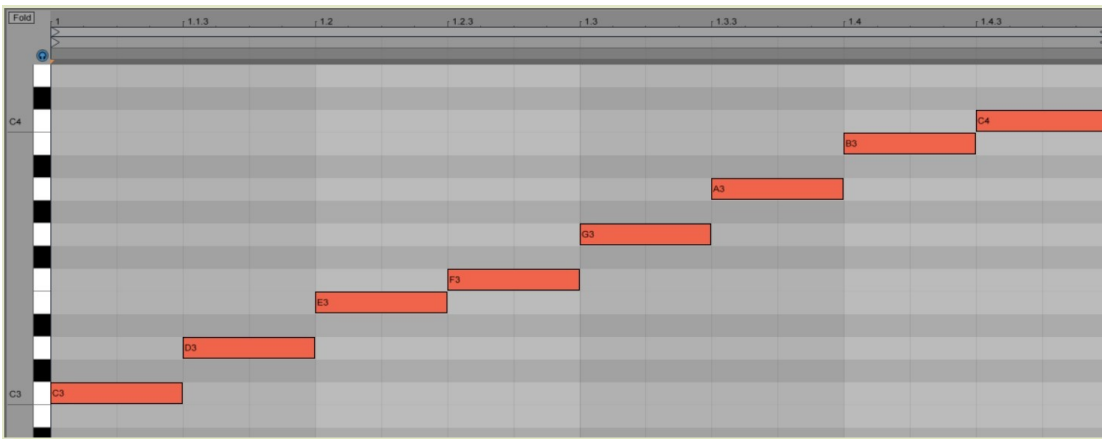
When we talk about chords, we are usually talking about groups of three or four notes. Technically, we can call any two notes a chord - it would be a type of chord called a diad. A diad is just a group of two notes. Usually though, chords are built as triads - a group of three notes. When we get into more advanced chords we will look at adding more notes, but let's start with the basic triad.

If a triad is a group of three notes, how do we know which notes? Do any three notes make a triad?

Yes, and no. Any three notes can be called a triad. But we usually follow a strict recipe to choose which notes to use, which ultimately make the best sounding chords that stay in a given key. In other words: if you want it to sound like chords you are familiar with, you need to follow the rules of how to build triads.

The notes we need to build triads are directly connected to the scale of the key we are in. First, we decide which note we want to build a chord on, then we take every-other note of the scale.

Let's go back to C Major, and look at our scale again.



Let's build a C major chord.

We are going to start with the root - keep in mind that the root of the chord can be different than the root of the key, or the scale. We can build a D triad using the C major scale, because it has a D in it. This is where we get the different "flavors" of triads - major and minor. If we build a D triad using a C major scale, we are going to end up with a D minor triad. More on this in the next chapter when we talk about diatonic chord progressions.

For now, let's stick with the C major scale, and building a C triad.

We need the root: so in this case, since we are building a C triad, the root will be C. Next we go up the scale, skipping the next note, D. That takes us to the pitch E. This is our second note that we need. We then skip the fourth note of the scale - F - leading us to the pitch G. This is our third (and final) note of the triad. So the three notes in C triad (in C major) are C - E - G.

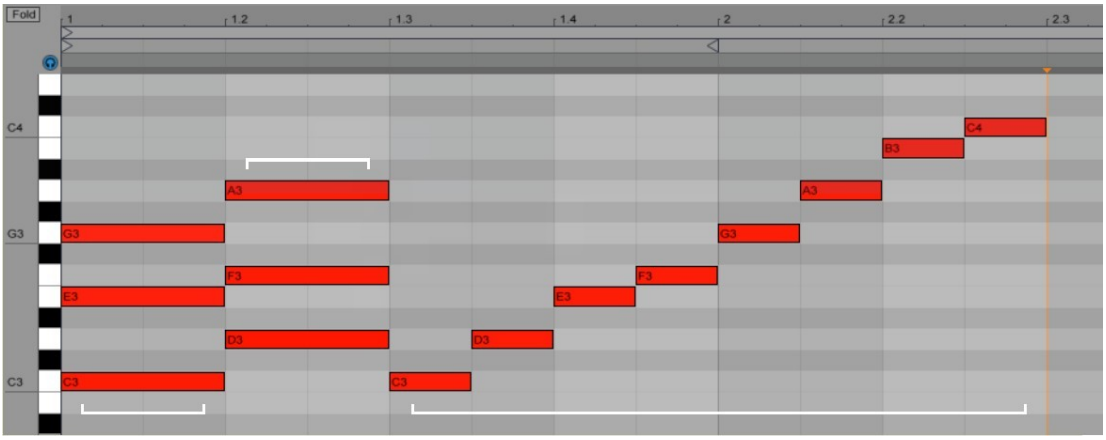
When we talk about building chords we often talk about using the, "First, third, and fifth". This is true in this case because we did use the first note of the scale, the third, and the fifth note. But that isn't always what we are referencing when we say "first, third, fifth." Really what we are talking about is using a root (the first), then the interval of a third above the root, and an interval of a fifth above the root. Remember though, that those notes are subject to the key we are in.

Keeping with the key of C major, let's build a D triad.

We start with the root of the chord we want to build, in this case D. Then we add a third above it - which we could find easiest by counting up the scale and skipping a note. So after D comes E, which we will skip, then we end up on F. That gives us the third of the chord. To find our fifth we can just skip the next note in the scale (G), and then we end up on A. So the notes in a D triad (in the key of C major) are D - F - A.

Now we have two triads built in the key of C major: a C triad and a D triad.

Highlighted in white from left to right: C Major Chord, D Minor Chord, C Major Scale



Hooray - we've built two chords. But we have a little problem here.

Let's look at this again, this time just using half-steps. How many half-steps are in the C triad between the first and the third? Remember that a half-step is the smallest possible amount of space we can move, regardless of the key. So we would count from C, to C#, to D, to D#, to E. That's five half-steps between the root of the chord and the third of the chord.

But what about in our D triad?

If we count half-steps again, we end up with D (the root), to D#, to E, to F. That's four half steps. If they are both triads, why don't they have the same amount of half-steps between the root and the third? The answer is because one of them is a Major triad, and the other is a minor triad.

8.1 Major vs Minor

Let's do a more complete analysis of the C and D triads here in (in C major):

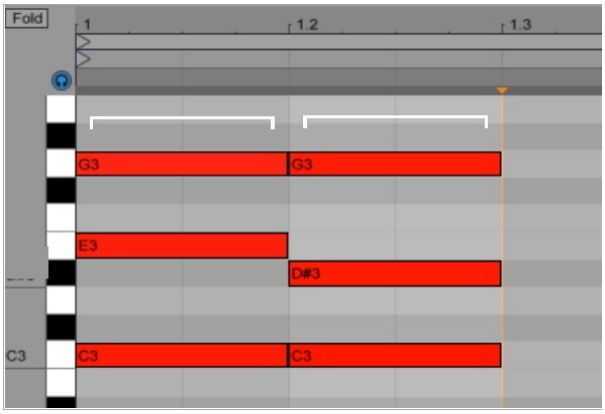
Triad	Half-Steps from Root to Third	Half-Steps from Third to Fifth	Half-Steps from Root to Fifth
C Major	4	3	7
D Minor	3	4	7

First, let's look at the distance from the root to the fifth. Remember, the "fifth" refers to the "fifth note of the scale above a given root." So the fifth of C is going to be G - just count up the C major scale four notes (C to D is one, then C to E is two, C to F is three, and C to G is four). The fifth of D is going to be A - just count up the C major scale (because that's the key we are in) four notes from D.

The number of half steps between C and G is seven, and the number of half steps between D and A is seven. So the distance from the root to the fifth is seven - whether a chord is major or minor - the distance between the root and the fifth stays the same. The distance between the root and the fifth is an interval that we already know - it's a perfect 5th. So in order to make a triad, we need a perfect 5th and one note inside of the perfect fifth - the third.

Next, let's look at the distance from the root to the third. In a major triad, it's four half-steps. In a minor triad, it's three half-steps. What does that tell us? Since we know that the distance from the root to the fifth is the same in both chords, it tells us that the third determines if the chord is major or minor. The third holds the power to turn a chord major or minor. Just as an example, let's look at a C major triad side-by-side with a C Minor triad:

Highlighted in white from left to right: C Major Chord, C Minor Chord



You can see here that the only difference is the third. And even more clear now is that the different between the two thirds is just a half step. If we have a major triad and we want to turn it into a minor triad, you just have to lower the third one half-step. Similarly, if we want to turn a minor triad into a major triad, you just have to raise the third by one-half step.

What about the distance from the third to the fifth of a triad? That always needs to be the opposite of what the distance from the root to the third is. To put that another way: One triad is made up of two thirds: a major third (4 half-steps) and a minor third (3 half-steps). In a major triad, the major third is on the bottom and the minor third is on the top. In a minor triad, the minor third is on the bottom and the major third is on the top.

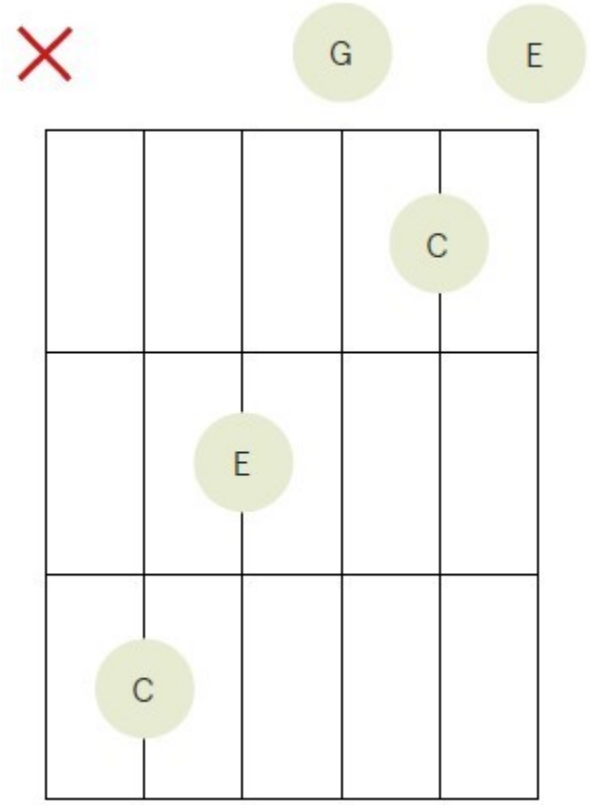
What is in a Triad?
A triad is made up of two thirds: a major third and a minor third.
Major Triad: Major Third + Minor Third
Minor Triad: Minor Third + Major Third

8.2 Octaves & The Guitar

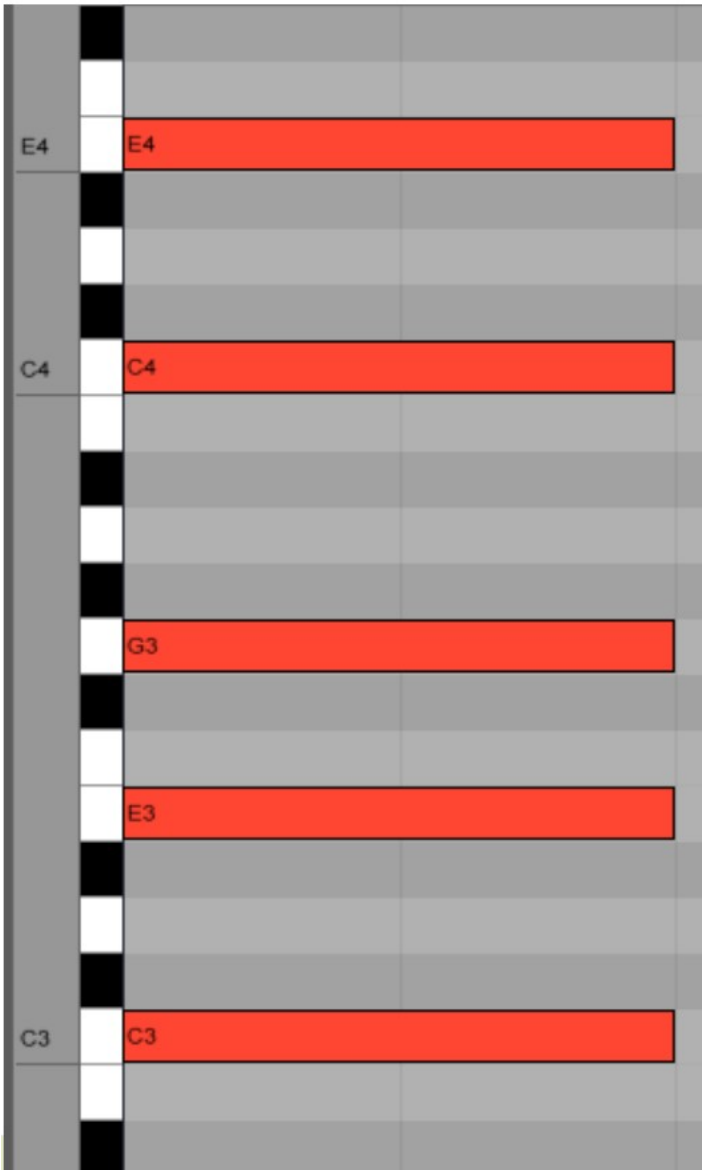
So far I've described a chord as a group of three notes. A triad is another way of saying a chord: triads are our most simple chords. If you know anything about playing the guitar, you might know that when you play a C major chord on a guitar, you strum five strings. How can there be five notes in the chord on a guitar, but only three everywhere else?

There can't. If someone is playing a C Major chord, they are only playing three notes. But we can repeat notes all we want. It might better be said that we are only playing three different notes. You can have an infinite number of octaves of those notes in a chord and it is still the same chord.

This is a guitar chord chart that shows the five notes that you play. The actual notes from low to high are: C - E - G - C - E. So really - it's only C, E, and G, with a second octave of C and E in it. If we wanted to represent that in our Piano Roll Editor, (in order to make a chord sound more like the way a guitar would play it), we would do it like this:



Here, we see only C, E, and G, but with a second octave of C and E in the chord. Even though this chord appears to have five notes, it is still simply a C major triad, because it only has three unique notes.



8.3 Moby, *Porcelain*

Moby is a great example to use here because he tends to use simple triads in his songs. Remember you can have more than three notes in a chord, and we will look at that soon. For now, let's keep it simple and look at *Porcelain* by Moby.

This song has a repeating pattern of four chords. Whenever we have a repeating pattern of chords we call it a chord progression. This chord progression is made up of the chords G Minor, B ♭Major, F Minor, and A ♭Major.

First, let's find the notes in all of those chords:

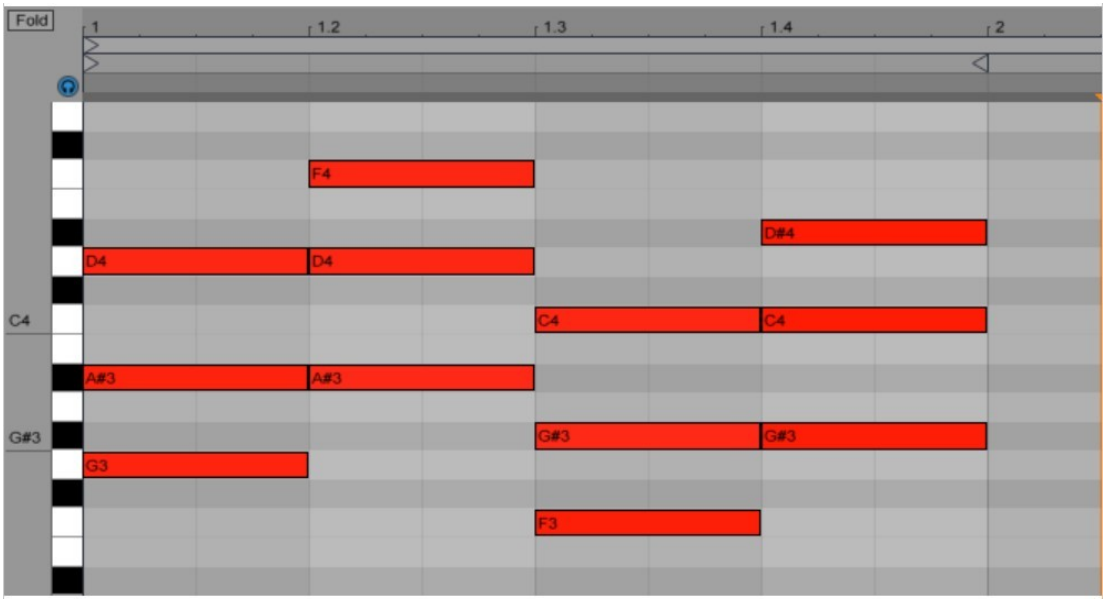
G Minor: The root of the chord is going to be G, and it's a minor chord so the third has to be three half-steps higher. That makes a B ♭. Then we would need the major third on top - three half-steps - give us a D for the fifth. We could double check that it worked out by making sure the distance from the root to the fifth is a perfect 5th. G to D is a perfect 5th, so we are all good.

B ♭Major: We start with B ♭as our root, then we need a major third above that (five half-steps), which gets us D. Then we need a minor third above that, which gives us an F.

F Minor: Starting with F as the root, we add a minor third (A ♭), and then a major third (C). So our F minor chord notes are F, A ♭, and C.

A ♭Major: A ♭is our root, so a major third above that would be C, then a minor third above that is E ♭. That gives us all our notes.

Now let's put it together: In the song there are two chords per bar, so we will put it together like so:



If you do this in your sequencer, you might say to yourself: "It sounds close - but something seems not perfect here." And you would be right! The thing that isn't perfect in this is that in the song Moby changes the vertical stacking of the notes just a little bit - meaning he puts the root at the top of the chord, instead of the bottom - in a few places. This is called an Inversion and we will be talking about it in chapter 10. But first, let's figure out why these particular chords work well together. To get to the bottom of that, we need to look at something called diatonic chord progressions. ►

9. Diatonic Chord Progressions

One of the most fundamental questions we try to answer with music theory is, "What notes will sound good together?" We've looked at this two different ways so far: we can lump notes together by scales and keys, or we lump notes together by triads (chords). We know that in order for chords to work, we need to be in a key because the key tells us what notes go in the chord, especially when it comes to the third. Without knowing the key we are in, we wouldn't know the scale to use, and then we wouldn't know if the chord should have a major or minor third.

Let's look at that another way. Going back to our C major example, and looking at the C triad and the D triad. We've learned the the C triad is a major chord and the D triad is a minor chord in the key of C major. But why? Why is the D minor and the C major? And for that matter - what if we built a chord on E in the key of C major? Will that be major or minor? What about F, G, A, or B?

To answer all of those questions, we need to look at something called the diatonic chord progression. Let's start by picking apart those three words and dealing with them one-by-one.

1. Diatonic: This is a word that means "in key." If something is diatonic, then it is locked into a key. The opposite of diatonic is chromatic - not in any key.
2. Chord: We know what this means now - it means our triads. "Chord" could also mean groups of more than three notes, so it doesn't always

have to mean just a triad.
3. Progression: A chord progression is the skeleton of any song: it is a sequence of chords that sound good together.

So if we put all three words together, what we have is diatonic chord progression: a sequence of chords that are all in the same key and sound good together.

In fact, what the diatonic chord progression shows us is all possible chords in a given key. It will answer both questions, "why is the D chord a minor chord in C major?" and "what if we built a chord on E, F, G, A, or B?" All of this can be answered with the diatonic chord progression.

9.1 The Pattern

There are two ways to learn the diatonic chord progression. One way is to figure out all the notes in all the chords, and find their quality (meaning major or minor). The other way is just to memorize a pattern. I want to walk us through both ways in this chapter, but let's start with the pattern.

There are not a lot of things in this book that I'm going to ask you to memorize, but this is one. This pattern will be the best tool you have when you are writing songs. It is an indispensable utility for generating ideas, finding ways to build on what you've already written, and finishing a track. This is the pattern:

M - m - m - M - M - m - dim - M

That pattern is the diatonic chord progression pattern, and it tells us all the chords in a given key. Let's dissect it a little bit: Capital M means "major" and lowercase m means "minor". So what this is saying is our first chord in a key will be Major, because the first M is capital. Going back to C Major, that means that if we build a chord on the tonic (the first note in C major) - C - it will be a major chord. If we build a chord on the second note of that key, D, it will be minor because the second m in the sequence is lower-case. We can keep going: if we build a chord on the third note of the scale (E, in this case), it will also be minor. The fourth note, F, will be Major. The fifth will be Major, and the sixth will be minor. So far so good, right?

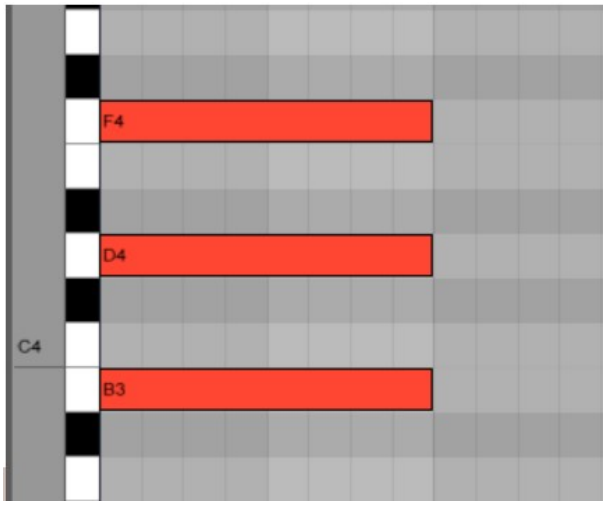
But then we get to the seventh note in the scale - the leading tone. In the example of C major it would be a B. The pattern says "dim" on that note. This is an entirely new kind of triad - something that is not major or minor.

9.2 Diminished Triads

You can think of a minor triad as a "super minor" triad. Remember that in order to make a minor triad we have two thirds: a minor third on the bottom, and a major third on the top. The diminished chord breaks this rule: It is made up of two minor thirds. No major third. But, as you can see in the diatonic chord progression pattern, one of them happens in every key.

The diminished chord has a fairly ugly sound. It does have it's uses, and you might want to experiment with it. But usually in popular music, and certainly in dance music, we just avoid it. In some cases you can use a regular minor chord in it's place, but if you want to strictly stay in key, you would usually just leave it out. Take a listen in your own sequencer by putting together these notes: B, D, and F.

The diminished triad is used a lot in jazz and classical, but rarely in any popular styles.



9.3 A Note About Chord Abbreviations

There are a number of different systems for how to abbreviate chord names. If you are looking at a chord chart, you might see chords written differently depending on the style of music it is. Classical music has a way, Jazz has a way, and popular music has a way. The most common abbreviations for chords we know so far are:

- Major: M, Maj, or no symbol (A chord labeled "C" would typically mean C major. If there is no symbol on a chord, it is assumed to mean major.)
- Minor: m, min, Min
- Diminished: Dim, dim, º (the subscript º is common)

9.4 The Chords of C Major

We can now complete the puzzle: we know all the notes in a given key because of the whole-step/half-step pattern, and now we know all the chords in a key because of the diatonic chord progression. So we can deduce the quality (major, minor, or diminished) for all the chords possible in a given key.

C Major

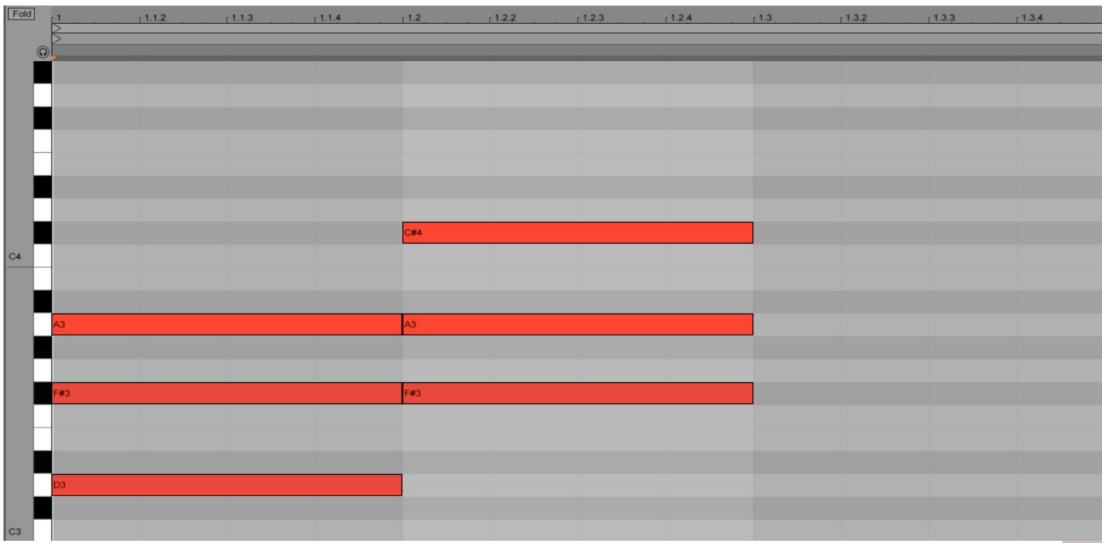
Note	C	D	E	F	G	A	B	(C)
Chord Quality	M	m	m	M	M	m	dim	(M)
Chord Names	CM	Dm	Em	Fm	Gm	Am	B°	(CM)

In the key of C major, we take the first note (C) and match it to the first chord quality from the diatonic chord progression (Major).

That tells us "C Major" is the first chord. Using the same process, it tells us that all of our other possible triads are: D minor, E minor, F major, G major, A minor, and B diminished. Note that we typically repeat C major at the end. That is the same chord as the first chord, because we are just showing the top and bottom of the scale.

9.5 Producing with the Diatonic Chord Progression

Let's create an imaginary track.



I've started our track with two chords, just because I like the sound of them. I found these two chords because they sounded liked they worked together, but I didn't think too much more about it. So far, my track looks like this:

The first thing we should do here is figure out what key this is in. We can do that by figuring out what chords we have, and finding a diatonic chord progression that both of those chords fit into. Once we know that, we can use the diatonic chord progression to find all the other chords that would work with these two.

If we count our half steps in the first chord, we quickly find that it is a D Major chord. The second has a smaller gap between the root and the third, so it is a minor triad. The root is F#, so together I have a chord progression of D Major and F# Minor.

Next, we need to find a diatonic chord progression that has both of those chords in it. Let's just use trial and error, starting with they key of C

Major. Look at the chart above that has all the chords of C major in it. Does it have a D Major? No - it has a D minor.

Does it have an F# Minor? No - it is an F Minor. (Any key always has a note or the note with an accidental, but never both.) So neither of these chords are in C major, so that can't be our key.

Just for fun, let's next try G major. If we follow our scale pattern to find all the notes of the G major scale, we would find:

G - A - B - C - D - E - F# - G

If we next apply the Diatonic Chord Progression to those notes, we end up with:

GMaj - Am - Bm - CMaj - DMaj - Em - F#º - GMaj

Is our first chord - D Major - in that chord progression? Yes, it has a D Major in it. So far so good. Does it have an F# Minor in it? No - it has an F# Diminished. Earlier when we talked about the diminished chord, I said a minor chord could substitute for a diminished chord sometimes, but it is still not the same chord. It has one note different, so while it can sometimes substitute, it is a different chord. So it doesn't totally work here.

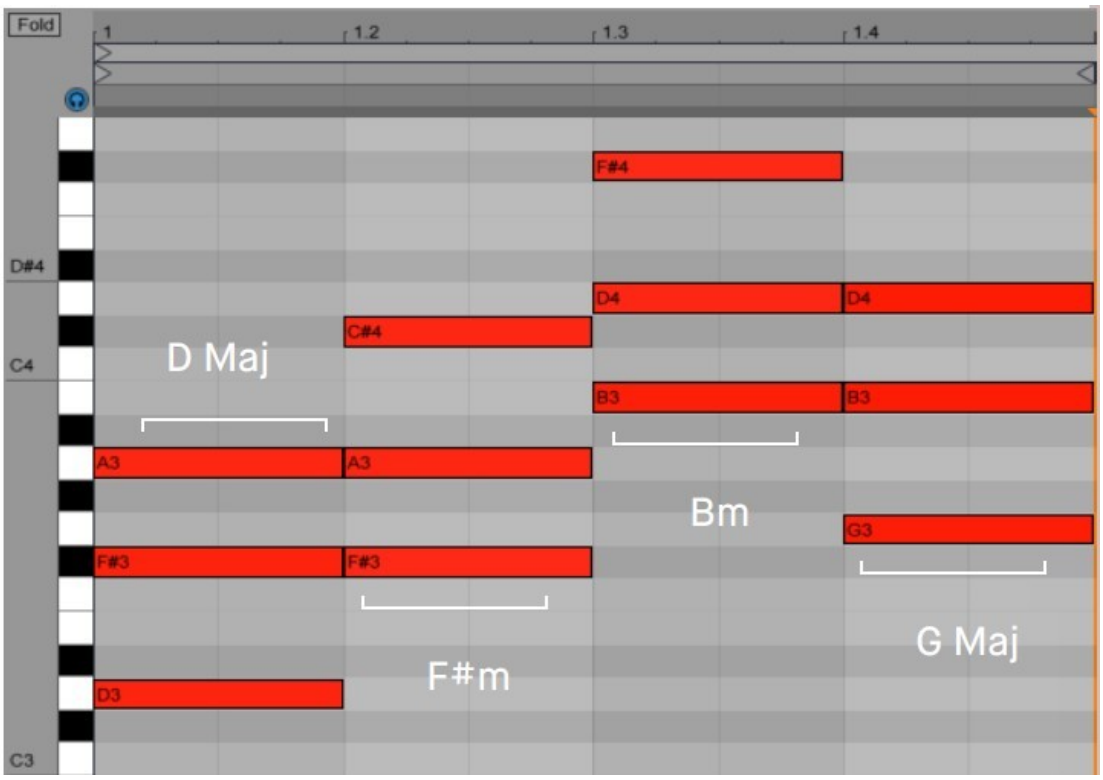
Let's try D Major. The Diatonic Chord Progression for D Major is:

DMaj - Em - F#m - GMaj - AMaj - Bm - C#º - DMaj

Does it have a D Major chord in it? Yes. Does it have an F#m chord in it? Yes. Bingo. That's our key.

Was there a faster way to find it?

Normally I would have started with the first chord - D Major, and took my first guess at the key of D Major. If that didn't work, I would have tried the second chord. Chords that are already in the chord progression are pretty good guess as to what the key might be.



Now we know that we are in the key of D Major, and we have the first two chords of a chord progression. Chord progressions can have as many chords as you want in them, but having four chords in a chord progression is fairly typical. So let's find two more chords. If we look back at our diatonic chord progression, we now know all the options that could work. Any remaining chord in the progression will sound good. We know that because it is in the key.

Good options would be: Em, GMaj, AMaj, or Bm. The chord of C#º wouldn't be a great option, but it might be worth trying. You might like the sound of it. I'm going to finish this chord progression with a Bm and a GMaj.

I like the sound of that, so I'll stick with it. There are a lot of different things I could have done with those last two chords, but once you have the diatonic chord progression for your key figured out, you know what your options are.

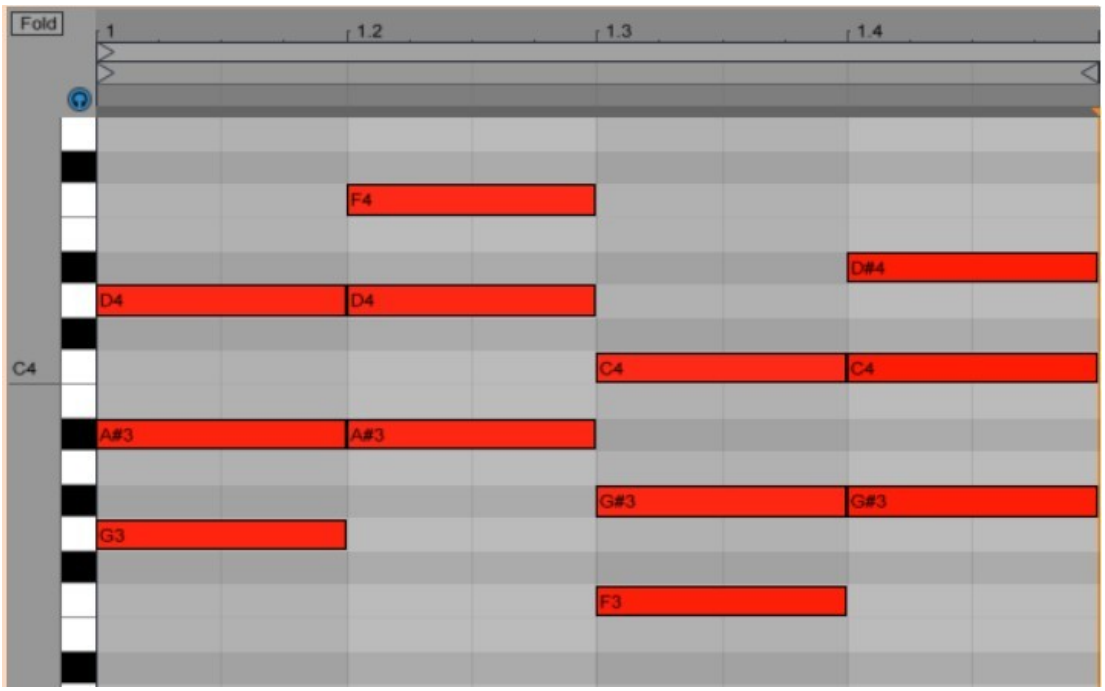
One last important note on this: What if you played the DMaj - F#m chords over and over, but didn't really like the sound of any other chords

in the D Major diatonic chord progression? That's ok. That just means you need to go outside of the key to find the chord you want. There is nothing wrong with that - in fact, if everyone always stayed in a single key music would become stale rather quickly. The "rules" here are made to be broken. How we break them is the crux of music theory. But don't ever forget rule number one: your ear always wins. If something sounds good to you, but doesn't make sense in any key - it doesn't mean you can't do it. It just means you are innovative. ►

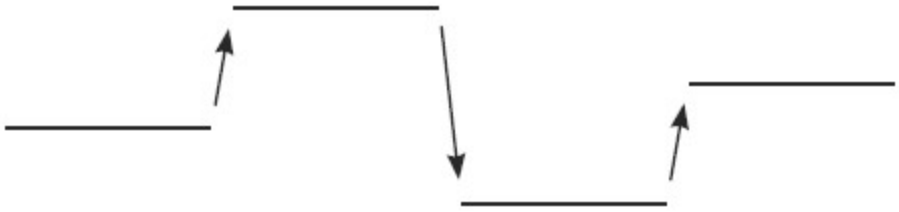
10. Inversions

Let's go back to Moby's *Porcelain* for a minute.

Remember when we looked at this back in chapter 8, I said these were the right chords - but there is still something else we can do to make it really sound like the song? What we have so far is all the right notes in all the right places. But we haven't arranged the notes the way Moby did vertically. If we really want it to sound like his track, we need to use the correct inversions.



Listen to ours, and think about the shape of the line. By "shape," I mean if you could draw a single line representing the sounds going up and down, what would it look like? Ours starts off on a chord, then the chord goes up, then the third chord down, then the fourth chord up again. The line would like something like this:



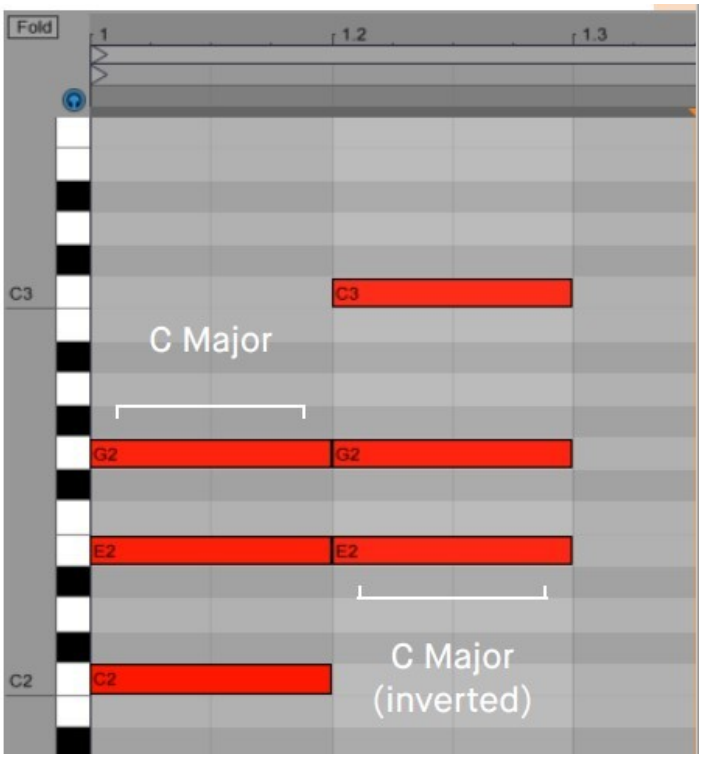
Now let's compare that to how the actual song sounds. The second chord goes up from the first, then up again (but just a little) on the third chord - and then back down.

How can this be? We have the right chords but the shape is very different. It's really only that third chord though: The chord should feel like it moves up, when ours moves down. The answer to this riddle is that we have the right chord, but the wrong inversion. Let's investigate inversions, and then we will come back to the Moby example.

10.1 Root Position

So far, all the chords we have looked at can be said to be in root position. Simply put: That means the root of the chord is on the bottom. We've built the chords using the pattern Root - Third - Fifth, so the root of the chord is the lowest note in the chord. That makes the third always the middle note, and the fifth always the top note. Using root position is just fine - there isn't anything wrong with it. But if you want your chord progressions to really flow from one chord to the other, we can use inversions.

Let's take a C major chord, in root position. If we take the root of the chord (C) and move it up an octave, we now have the root of the chord on the top.



If we look at the notes in both chords, they are the same: C, E, and G. Except in the inverted chord, C (the root) is now on the top. This can make counting half-steps a little tricky: We need to be sure that when we count half steps in a chord (to determine if it is major or minor), we have to first put the chord in root position. If it isn't in root position, it doesn't work.

Think of a chord like a hand in poker.
You have a set of cards in your hand. Re-arranging the order they are in doesn't change what cards you have in your hand. But they might look different if you put them in a different order. Similarly, if we change the inversion of a chord, we still have the same notes, and the same chord. But it sounds a bit different.

10.2 Inversion Types

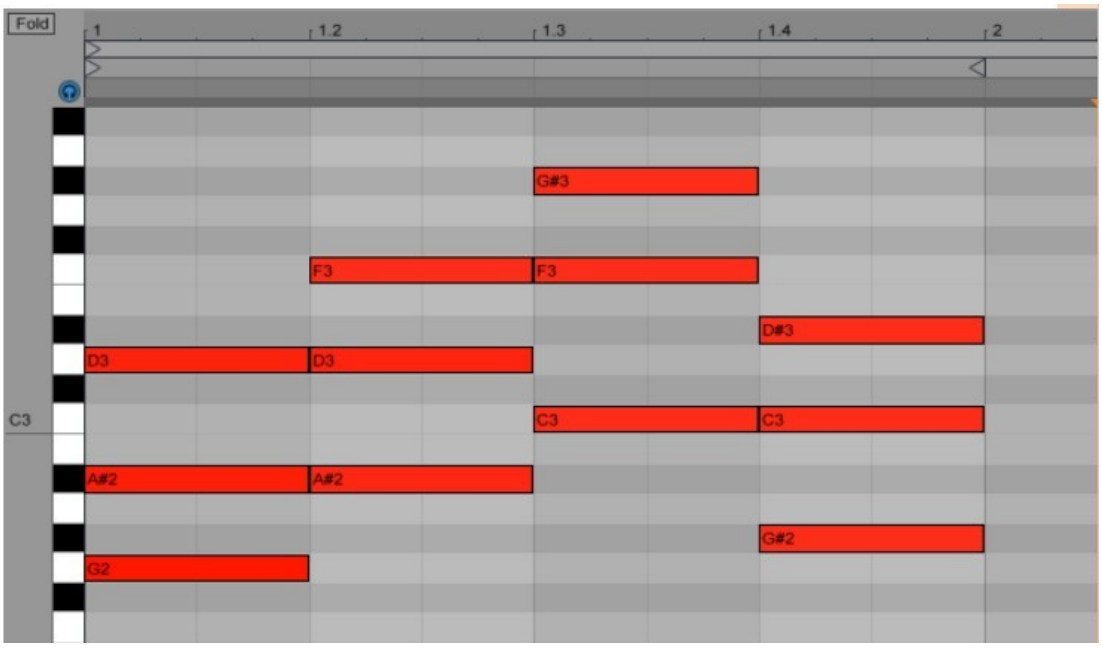
There are two inversions we can do to a triad. We talk about these inversions based on what is on the bottom: in the above example we put the third on the bottom (really, we moved the root to the top, but it's easier to keep track of inversions based on what is on the bottom, since that's how we do it for root position.) We can also put the fifth on the bottom, since moving the root and the third up an octave. (Or just moving the fifth down an octave).

I'm not big on terminology, but I would be remiss if I didn't at least mention that these inversions have technical names. The inversion that has the third at the bottom is sometimes called first inversion, and sometimes we use the subscript number 6 to indicate this inversion. (6 because of the distance from the lowest note (the third) to the highest note (the root) is the distance of a sixth in this inversion). For the inversion with the fifth in the base we can call it second inversion or use the subscript 6/4. The 6/4 indicates the distance from the lowest and highest notes (again, a sixth in this inversion), but to separate it from first inversion we also include the number 4 to show that there is a fourth in it, the distance from the lowest note (the fifth) to the middle note (the root).

If that last paragraph has your head spinning - don't worry about it. Just remember that we can re-order the notes to make the chord flow better from one chord to the next. This is incredibly common in electronic music chord progressions.

10.3 Moby, *Porcelain*, Take Two.

Back to *Porcelain*: Can we use an inversion on that third chord to make it match the line that we hear in the song? We can:

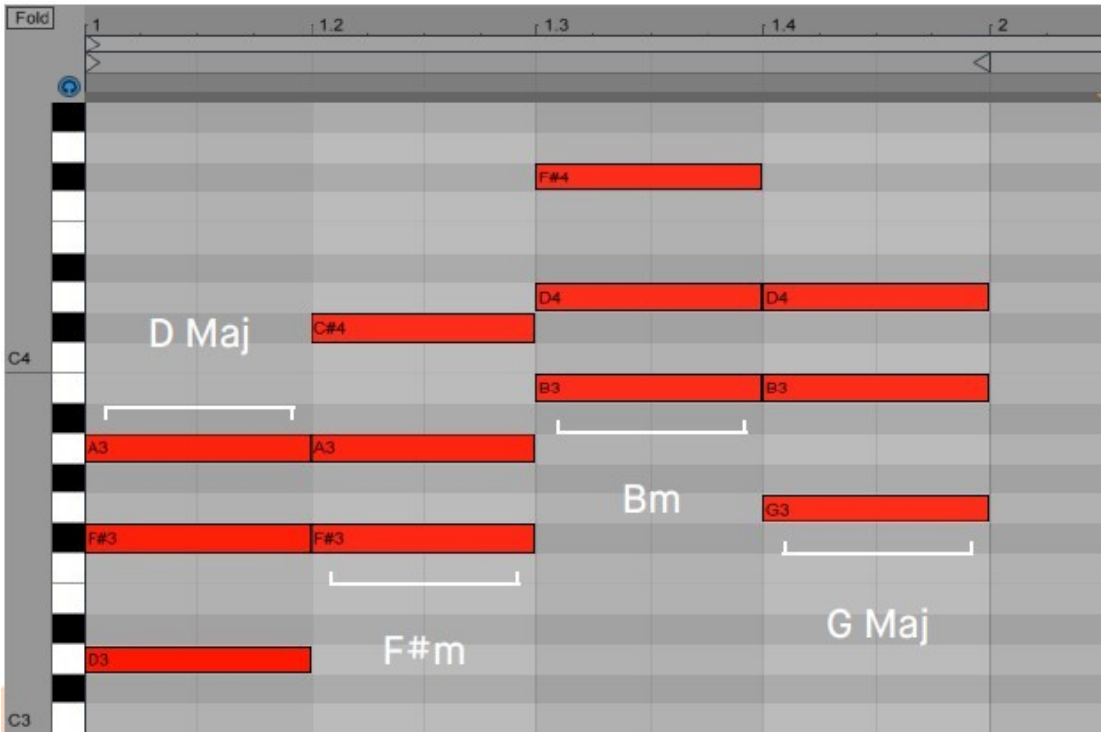


All I've done here is put the third chord into second inversion. That put the root in the middle, and the fifth on the top. That makes it feel like the chord is moving up and makes it work with the line that we hear.

10.4 Producing with Inversions

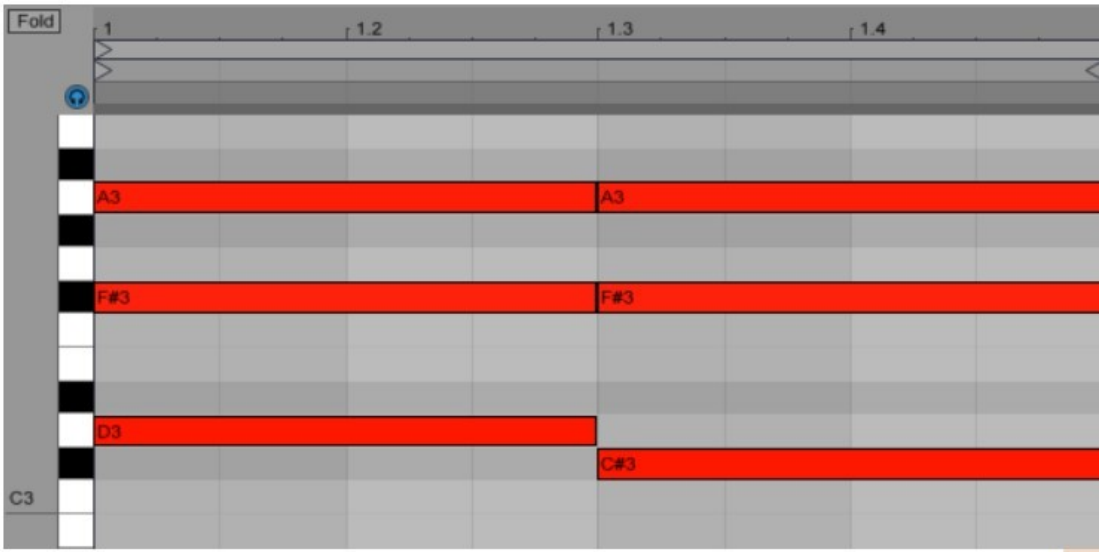
Let's take the chord progression we came up with in the previous chapter and see if we can make it sound a little more interesting.

In this chord progression, all chords are in root position. That can be ok, but it usually isn't going to sound very interesting. Let's re-arrange the inversions so that, without changing any notes (only octaves), we have each note leading from one to the other with the least amount of motion.



Imagine each note in the chord is being sung by a person. They can only sing one note at a time, so we have three singers here. In order to sing their part the easiest, we need each note to move as little as possible. For example: I'll leave the first chord in root position, but I can already see that the person singing the lowest part is going to have to jump from D up to F#. But if I instead move the C# that is on the top of the second chord down an octave, then the lowest singer only has to move a half-step down. Much easier. In doing that, I've made it so that the middle and the top singers don't have to move at all to make the second chord. That is going

to sound much smoother if it was done by singers, and it is going to sound much smoother for us as well.



Ahh... much smoother.

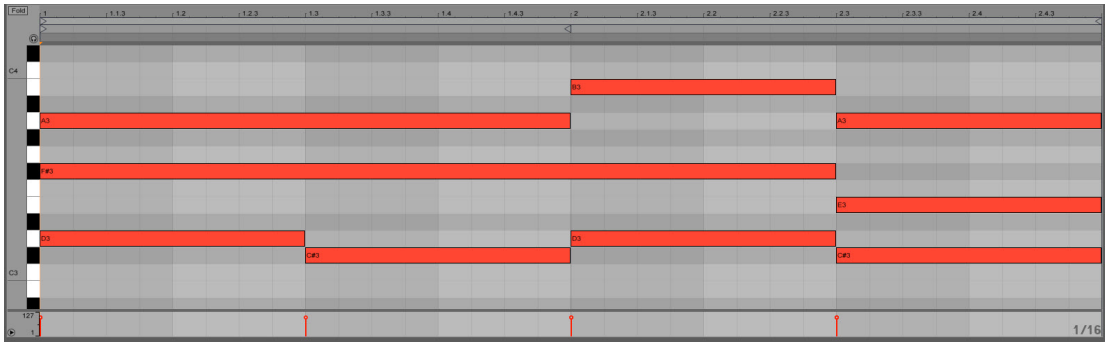
Let's keep going. If I move around the inversion of the third chord I can make it so the middle "voice" doesn't have to move at all, the top voice moves up a whole-step, and the bottom voice moves up a half-step. The fourth chord has no notes in common with the third chord, so all the notes have to move. But I make make their movement be as small as possible by using first inversion: that puts the root at the top, and makes all the other voices only have to move a whole-step or less.

This is sounding much more interesting, just from moving those notes around.

But we have one more question to answer: for the notes that don't change between the chords, can I just let them continue into the next chord? Look at the first A, the top note of the first chord. Could that note just sustain all the way to the third chord? It could.

Depending on the style of music you are making you may or may not want to do that. If I was using a string sound or a pad, I would not reattack that note and just let it sustain all the way through. The same goes for all the other notes that are continuous through the chord.

I've now turned my not-so-interesting chord progression into something really usable, just by inverting some of the chords to make it flow smoother.



Voice leading is something that you can incorporate anytime you are using chords. Don't let the term "voice" fool you. It doesn't have to have anything to do with singers. Chords arranged with good voice leading from one chord to the next (like we just did above) has a smoother sound. It lets the chords flow from one to the other without being so "blocky." You might want a smooth chord sound in your track, or you might want a blocky sound. If you want a smooth sound, this is how you do it.

So far we have talked about the octave, the fifth, and the third. We've also talked about the scale, which has all of our possible intervals in it. The intervals in the scale that don't contribute to a triad tend to get less attention but they are no less valuable. Let's take a look at the fourth, the second, and the sixth in this chapter. ►

11. The Other Intervals

11.1 Interval Inversions

Just like a chord can be inverted, so can individual intervals. For example: the note C up to the note G is a fifth. But the notes G up to C is a fourth. That is because the intervals are inverted. Think about walking up the scale. In C major, our notes up to G would be:

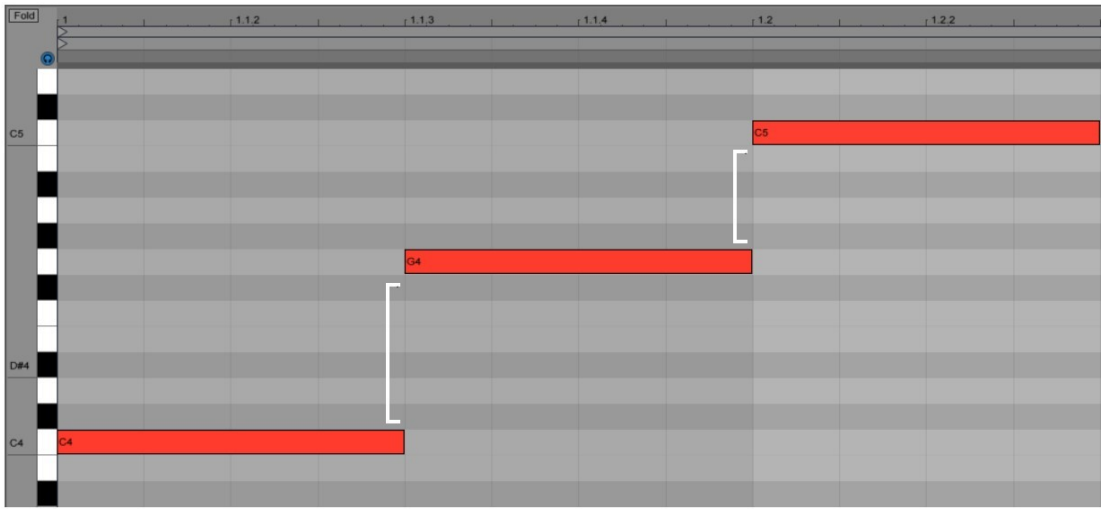
C - D - E - F - G

Those five notes tell us that it is an interval of a fifth. Now let's use the same scale and count from G up to C.

G - A - B - C

Only four notes.

From left to right: Perfect Fifth, Perfect Fourth



The rule is that whenever you invert a chord, it changes to a new interval name with the opposite quality. The exception is the perfect fifth, which inverts to another perfect interval (perfect fourth). In all other cases the inversion will have the opposite quality as the original interval (major becomes minor, minor becomes major).

Original Interval	Inverted Interval
Minor 2nd	Major 7th
Major 2nd	Minor 7th
Minor 3rd	Major 6th
Major 3rd	Minor 6th
Perfect 4th	Perfect 5th
Perfect 5th	Perfect 4th
Minor 6th	Major 3rd
Major 6th	Minor 3rd
Minor 7th	Major 2nd
Major 7th	Minor 2nd

If you are a math-minded person, you can figure out the inversion by just remembering that the two numbers need to equal nine. So the inversion of any interval is [Interval + x = 9, where the quality of x is inverted].

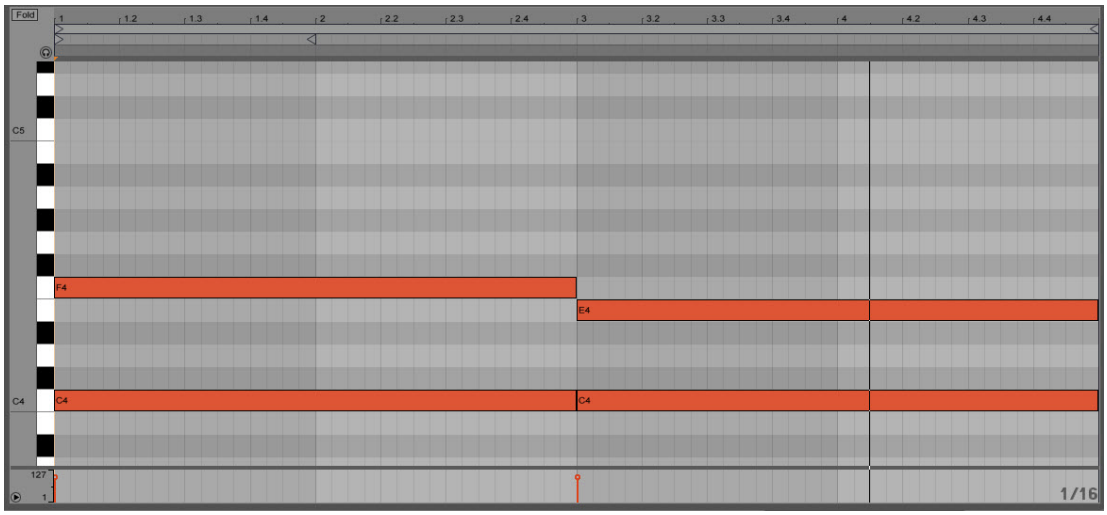
If you are not a math-minded person, you can just logically figure these out pretty quick. Think about a minor 7th, for example. Let's assign the notes C up to Bb. That's a minor 7th. If we invert it, and count B ♭up to C, how many half-steps do we need to count to get to C? Just two, (B and C). Two half-steps is a major 2nd. So a minor 7th inverts to a major 2nd.

11.2 The 4th

In one way, we've already looked at the 4th: as an inversion of the 5th. The interval of a 4th doesn't get used very often in chords. That is, a triad with a 4th in it. That would make it clash with the 3rd (in a major chord, which would only be 1/2 step away from the 4th), and is typically not a sound we like.

The 4th by itself though has a very interesting tendency. It tends to want to move some place else. Plug this in and listen to it:

This is an interval of a 4th. It sounds unstable, like it wants to move to another place. If it doesn't sound unstable to you, then odds are you're a guitar player. Guitars are tuned in 4ths (each string is a fourth away from the next), so guitar players get very comfortable with the sound of a 4th. But either way, let's now follow the 4th with a 3rd.



Now the 4th is resolved. 4ths tend to want to fall down to a 3rd. You can see in the piano roll editor that the pitch F just moves down one half-step, and that makes a 3rd with the root note.

Watch out: Intervals and chords are commonly confused!
What we are talking about here is the interval of a 4th: meaning, the two notes that make a 4th. This is entirely different than talking about the IV chord (which we will encounter in a few chapters). It would not be accurate say that the IV chord wants to resolve down to the III chord. These are apples and oranges.

11.3 The 6th

Unlike the 4th, which is a perfect interval, the 6th can be major or minor. If you remember back when we talked about the 3rd, we learned that the 3rd is very powerful because it determines if the chord is major or minor. The 6th carries some of that power with it, because it is an inversion of the 3rd.

11.4 The 2nd

Like the 6th, the 2nd can be major or minor. Its inversion (a 7th) will become very important in chords starting in the next chapter. The 7th is a very distinctive sound, so it is sometimes hard to use a 2nd for anything without it sounding like an inverted 7th. This will make more sense after we explore 7th chords in the next chapter.

11.5 Suspended and Add Chords

Both the 4th and the 2nd can be added to major or minor triads, although it is not extremely common. The result is either what we call a "suspended" chord or an "add" chord, depending on what you do with the 3rd.

For example, if I add a 2nd to a chord, and leave everything else the same, we would call that an "add2" chord. If we take a C major triad (C-E-G), and put a 2nd in it (C-D-E-G) we have made a Cadd2 chord. But if we instead substitute the 3rd with a 2nd, making the notes (C-DG), we have what we call a "suspended" chord. This works the same for the 4th as well.

Modification:	add2	add4	sus2	sus4
C Major Triad:	C-D-E-G	C-E-F-G	C-D-G	C-F-G
Chord Name:	Cadd2	Cadd4	Csus2	Csus4

Suspended and add chords can give a chord progression a nice extra addition. ►

12. 7th Chords

So far we've looked at chords that are built on three notes, called triads. We know how to find all the triads in a key, and we know how to put them together to sound good. Triads are great, but we can go a step further and make our chords more colorful by using four notes in our chords instead of three. We call these 7th Chords.

12.1 Producing with 7th Chords

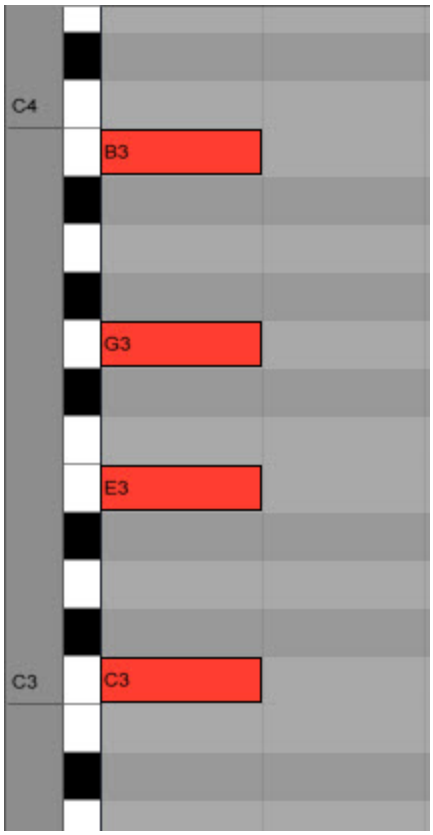
7th Chords are triads with one extra note, so they have four notes total. All the rules of the diatonic chord progressions, intervals, and inversions still apply. 7th chords can give us a more refined feeling of the chord. If a major chord is "happy," a major 7th chord can be "pretty." If a minor chord is "sad," a minor 7th chord could be "melancholy." By using 7th chords we allow more expression into the harmony than just the "happy" and "sad" qualities of the major and minor chords.

It's worth noting that just because 7th chords have more notes, they are not always the best choice. Using nothing but 7th chords will give your track a "thicker" sound, and might even start to feel a little bit like jazz. When you are using 7th chords, don't be afraid to mix them up with triads. You could have a track that is mostly triads, but uses one 7th chord in the progression. In fact, you will find that to be a fairly common approach.

12.2 The Structure of a 7th Chord

The number seven in the name "7th chord" doesn't mean it has seven notes. It refers to the interval above a given root, in the same way we derived our first three notes of a triad. In 7th chords, we still use the first (root), third, and fifth - every other note above the root. But now we go one step further and add the seventh.

Notes from top to bottom: Seventh, Fifth, Third, Root



It's important to realize here that the underlying triad is not changed. We start with a root, and go up the scale: skip the second, add the third, skip the fourth, add the fifth. Just like a regular triad. But in a 7th chord we continue on with the same scale: skip the sixth, and add the the seventh.

When we made triads using the diatonic chord progression, we had two chord qualities that were formed because of the pattern of the key: major and minor (and that one pesky diminished chord, but let's leave those out

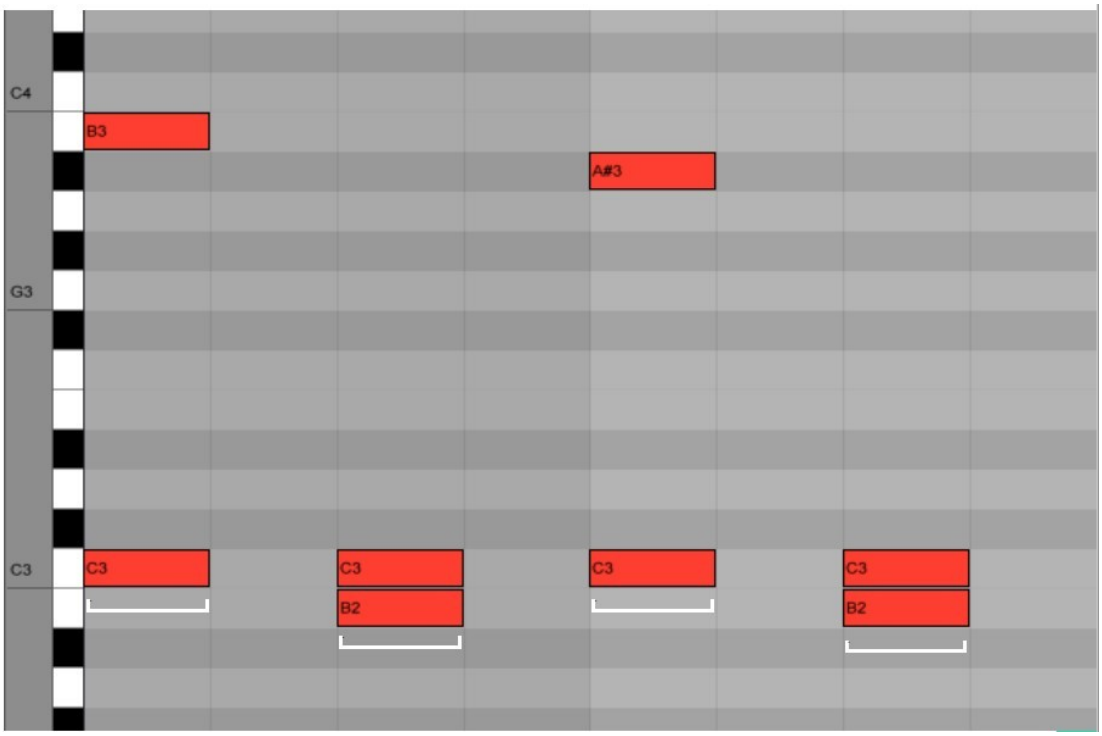
for now). In 7th chords we can actually have four qualities of chords that emerge.

12.3 The Four types of 7th Chords

In order to figure out the quality of a 7th chord, we typically divide it into two different elements: the triad, and the 7th. The triad can be major or minor, and the 7th can be major or minor.

In the example above, we can see the notes C, E, G, and B. We know that C, E, and G is a C Major triad. Next let's look at the 7th: is the 7th (the interval itself - the notes from C up to B) major or minor? If we count the half-steps, C up to B is 11. 11 half-steps make a major 7th, and 10 half-steps makes a minor 7th.

Marked intervals from left to right: Major 7, minor 2nd, minor 7th, Major 2nd



Want a short cut? Remember that the interval of a major 7th will invert to a minor 2nd. And a minor 7th will invert to a major 2nd. C to B inverts to a minor second: two notes as close as they can possibly be together (a half-step). That means that C up to B is a major 7th.

Why use the inversion?
It's just math! Counting half-steps up to 11 takes more time than counting half-steps down to two. So if you in the habit of seeing a major 7th as a minor 2nd, it can save you time. If you don't like that approach, counting up to 11 is just as good.

The chord with the notes C, E, G, and B is a major triad with a major 7th. As a shorthand, we simply call that combination a "Major 7th" chord.

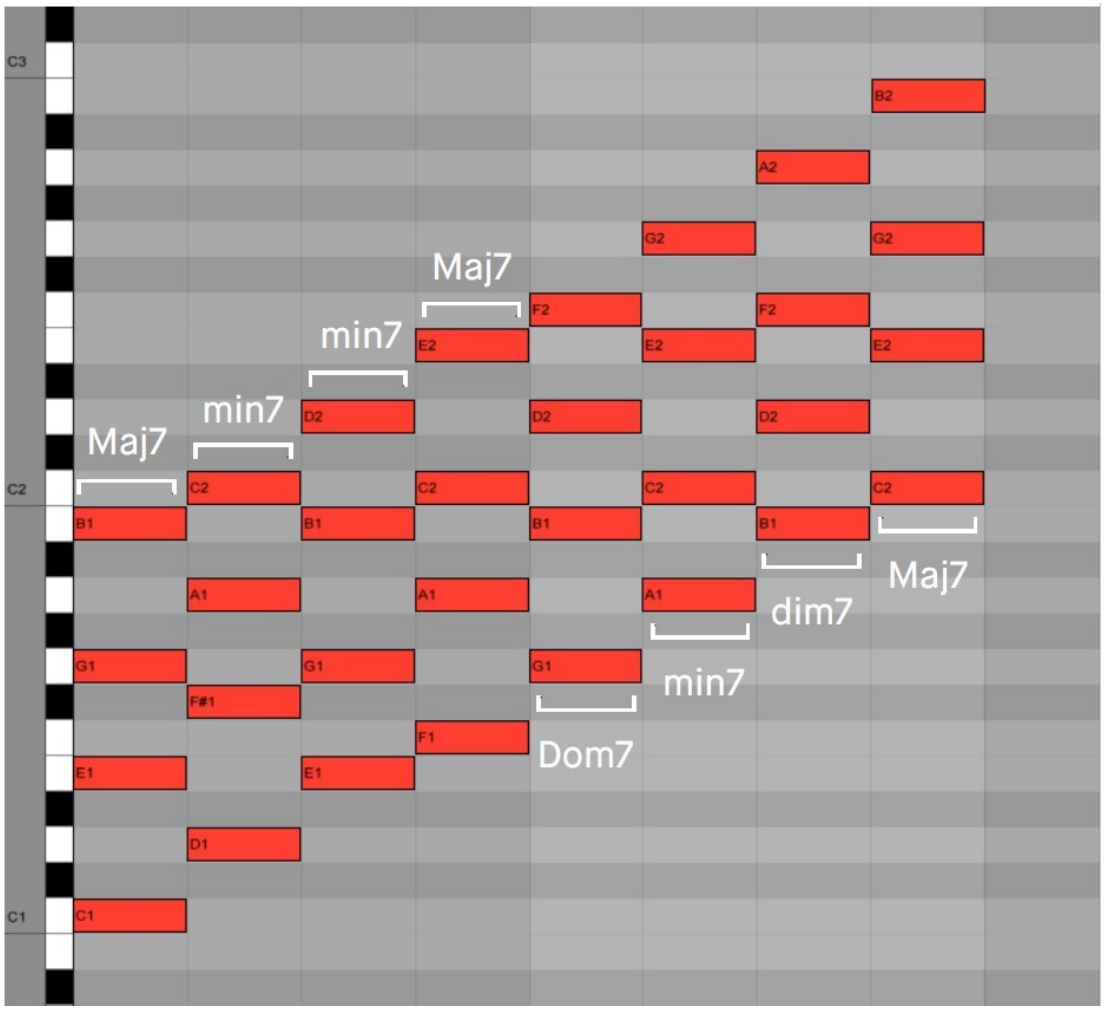
It is abbreviated a number of ways, including maj7, Maj7, M7, or ▲7.

Next, let's look at a minor chord. Let's take a minor triad that we already know: D minor. The notes are D, F, and A. If we add a 7th (in the key of C major), the 7th will be C. Since we already know we are starting with a minor triad, we just need to figure out if the interval of a 7th in this chord is a major or minor 7th. The interval of the 7th is always from the root of the chord to the 7th of the chord, in this case D up to C. If we count half-steps up, we end up with 10. (If we invert the C to put it at the bottom, we find a major 2nd, or a whole step.) That means the 7th is a minor 7th.

D, F, A, and C makes a minor triad with a minor 7th. We simply call that a "minor 7th chord." This is sometimes abbreviated to min7, or m7.

These two chords (the Major 7th and the minor 7th) appear "naturally" all over the diatonic chord progression. In other words, if we go back through our diatonic chord progression, but use four-note chords instead of three-note chords, we will find those two types of chords in multiple places. The other two types of 7th chords are a little more specialized. Let's look at the diatonic chord progression again, with 7th chords this time, and then deal with those other two types of 7th chords.

12.4 The Diatonic Chord Progression with 7th Chords



What we see in the progression is that, for the most part, chords that were major triads before are now Maj7 chords, and the chords that were minor triads are now min7 chords. There are two exceptions: the dim7 chord and the Dom7 chord.

Just like our diatonic chord progression using triads, this one shows us a pattern that will work in any key. The pattern for 7th chords is:

Maj7 - min7 - min7 - Maj7 - Dom7 - min7 - dim7 - Maj7.

The diminished 7th chord is still just a diminished chord like we've seen before, except it has a 7th on it now (a minor 7th). You may hear it called a "half-diminished 7th chord." This is actually not one of our four types of 7th chords, because diminished 7th chords get treated a little differently. The diminished 7th chord has a similar sound to the diminished triad.

12.5 The Dominant 7th Chord

The biggest difference here is the introduction of the Dom7 chord. This is short for "dominant 7th," and is a very powerful chord. This is the fifth chord in the sequence, and if we look at the fifth chord in the sequence from when we just used triads, we can see that it is a major chord when it's a triad. But as a 7th chord, it gets a whole new name.

The dominant 7th chord is made up of a major triad with a minor 7th. The notes that we have in this particular chord are G - B - D - F. The first three notes make a major triad (G major), but the pitch G up to F is only 10 half-steps - a minor 7th. Whenever this combination happens, it gets called a dominant 7th chord. It can be abbreviated as Dom7, or simply with the number seven. (For example, if you see D7, you are being asked to play a D dominant 7th chord: D F# A C.)

12.6 Chord Function, Tendency, and Resolution

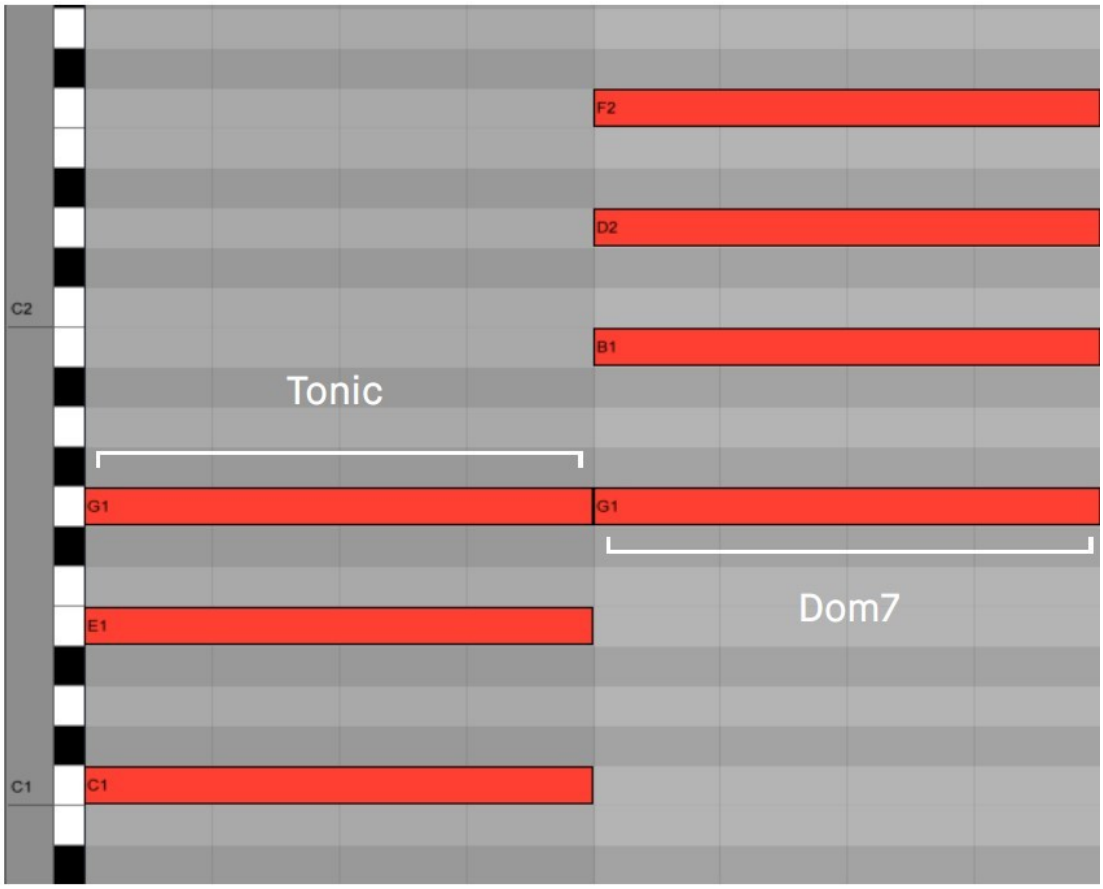
Not all chords behave the same way.

Some chords are happy to stay right where they are, and some want to move to another chord. We call this desire to move function, and where the chord wants to move is the chord tendency.

For example, the tonic chord has no tendency. You can play a tonic chord for hours and it will not give you the sense that it wants to change to anything else. The function of the tonic chord is stable, it has no tendency.

It's no accident that we call the dominant chord "dominant." It has a very strong tendency to move somewhere. So strong, in fact, that it can dominate a chord progression. The dominant chord wants to move back to tonic. Tonic, in the case of the dominant chord, is called its resolution. When a dominant chord has moved to tonic it is said to have resolved.

Strong Tendencies
There is a famous story from Mozart about this. Supposedly his dad would wake him up in the morning by playing, quietly, a dominant 7th chord on the piano, and then just waiting. The young Mozart would jump out of bed, the piano, and resolve the chord by playing tonic. The frustration of the unresolved chord was so strong it ripped out of bed to play the resolution.



Listen to the above example, at a slow tempo, and be sure not to loop it. Just listen to the two chords. Do you feel that the second chord wants to return to the first? That is the tendency of the dominant.

It is important to note that the dominant 7th chord only appears once in the diatonic chord progression. It only happens as the fifth chord in the pattern, or, built on the fifth scale degree.

12.7 The "Psycho Chord"

The last 7th chord is the most rare: it does not appear anywhere in the diatonic chord progression, and is not a particularly nice sound. It is a minor triad with a major 7th. We abbreviate this as mM7, and it's sometimes called, "the Psycho Chord", or the "Hitchcock Chord" because of its use by Bernard Herman in the soundtrack to the film Psycho. As you can probably assume from that, it is a rather harsh sounding chord.

This chord does not "naturally" appear anywhere in the diatonic chord progression but that doesn't mean it doesn't exist. It just means that in order to make it, you have to use some notes that are out of the key. ►

13. Roman Numerals

Perhaps you've heard people talk about music using language like, "I - V - I," pronouncing those symbols as roman numerals ("one - five - one"). This is a technique for conveying chords in relation to a tonic that goes back at least two centuries. It has become a standard convention in all styles of music, and it will become indispensable to us once we start analyzing works of other producers (which we will start doing in the next chapter). So it's important to understand how it works.

The first thing to realize about roman numeral analysis is that it is just a way of writing things down and talking about chords. It doesn't change anything in the music. Think of it like another language: we are still talking about the same chords, just using a new system to describe them.

So why bother?

The roman numeral system has one element that makes it invaluable to us when looking at chord relationships: transposition. Using roman numerals, we can talk about chords without talking about a key. That means that if we call something a "I - V - I", and then we change the key, it is still a "I - V - I". To take it a step further, once we know what a "I - V - I" sounds like, we can then use it in our music, in whatever key we want. You might find that you like the way Aphex Twin uses the III-VI chord progression, if you know how to make one yourself, you can use that same thing in your own music.

13.1 Roman Numeral Notation

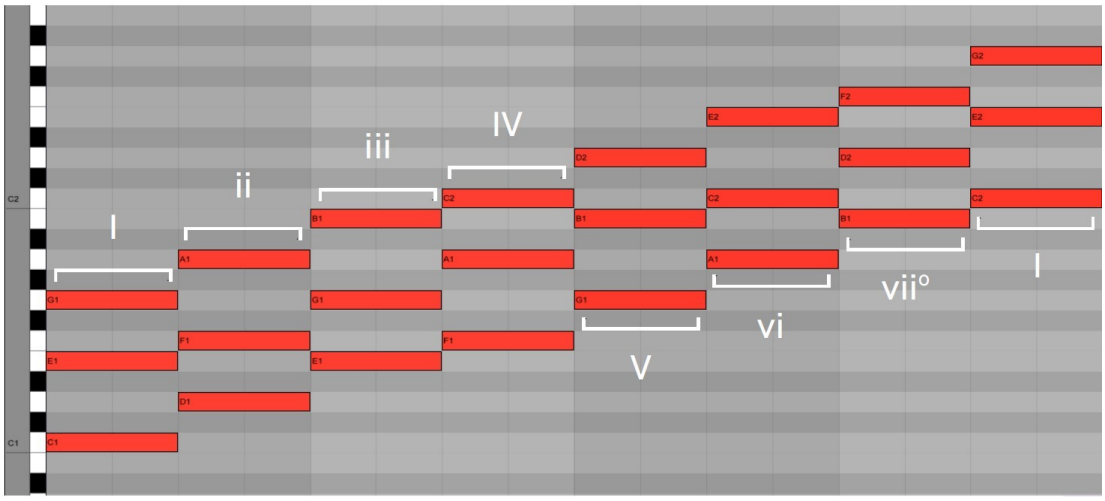
To use the system of roman numerals for your chords, follow these rules:

1. The chord is always called by the root note's distance from the tonic, counting upwards. For example, if we are in the key of C major, a C major chord would be "I". The G major chord would be "V". An F major chord would be "IV".
2. Use capital roman numerals for major chords, and lowercase for minor chords. For example, if we are in the key of C, a D minor chord would be "ii", and E minor chord would be "iii".
3. For diminished chords, use lowercase and include the subscript º. For example, in the key of C major, the B chord would be viiº.
4. Use numbers after the numeral to indicate 7th chords, or any extra notes added to the triad. For example, in the key of C major, a G7 chord would be V7. A D minor 7th chord would be ii7.

In the list above, number four requires a little more explanation. If V7 is the dominant 7th chord, then how can ii7 get the same notation? The answer is that we can assume a lot in the roman numeral system. In a ii7 chord, we know that the triad is minor, because the ii is lowercase. We know it has a 7th, because it shows a 7 on the numeral. But how can we tell what kind of 7th it is? We can tell because it is showing us that nothing is out of key. You can read "ii7" as: a minor triad with the 7th that is in key for that chord." If we wanted a 7th that was out of key, we would use some other symbols. *

13.2 Using Roman Numerals

Let's start by looking at our diatonic chord progression again, but this time lets look at it using roman numerals.



In this example, all the chords are in order, so the numbers will count up to seven. Notice that we don't ever use the roman numeral VIII. We just call that I again.

Remember that our pattern of the diatonic chord progression was this:

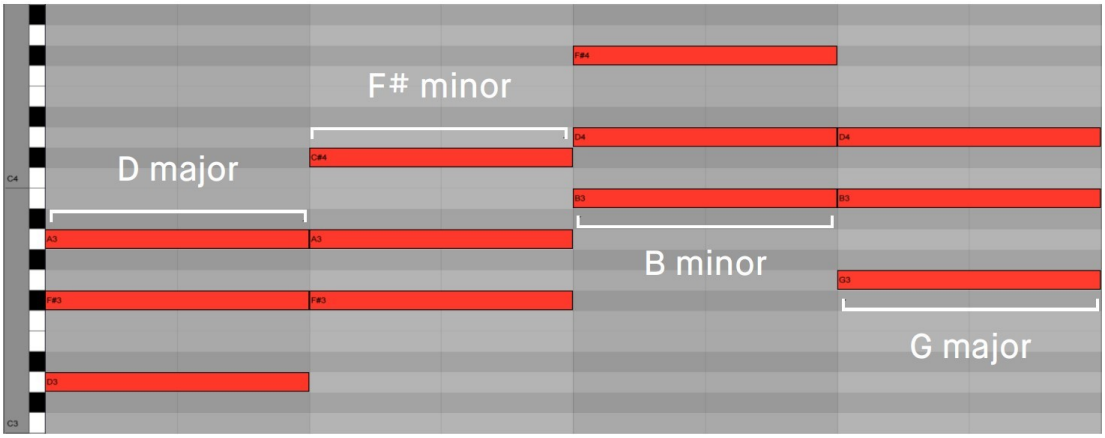
M - m - m - M - M - m - dim - M

We still have that, and we can actually see one more thing that we couldn't see before. We can now see the relationship of the chord to the key, and its function. Knowing that the second chord is minor is good, but knowing that it is a "ii" is even more useful. You will grow to hear chord functions as their relationship to the key, and find sounds that you like. Our pattern looks like this now:

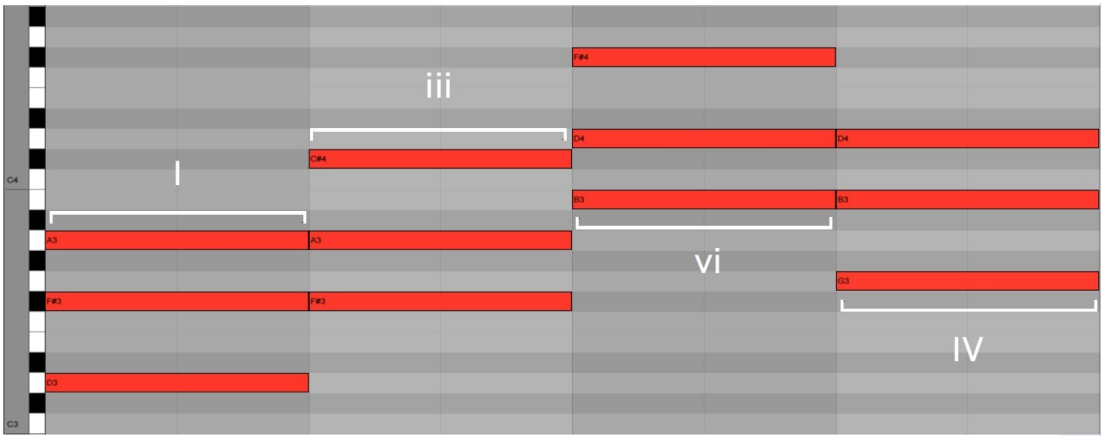
I - ii - iii - IV - V - vi - vii^{o} - I

13.3 Examples of Roman Numerals

In chapter 9, we put together a song using the chords D major, F# minor, B minor, and G major.



If we look at that same chord progression using roman numerals, we can see a little bit more of what is going on:



If you like the sound of this chord progression, then what you like could be said to be a "I - iii - vi - IV" progression. If you like just the last two chords, then you like a "vi - IV" progression. You can pull out whatever you want from this, and you can put it in any key, any tempo, and any style.

In the jazz and blues world, it is not uncommon to walk on stage not knowing anything about the song the band is about to play. Someone will

say, "I-vi-ii-V in G" and thats all you get. You are expected to know how to play those chords on your instrument. In this case, the key is G, so a I-vi-ii-V chord progression would be G major (I), E minor (vi), A minor (ii), and D major (V).

In the rest of this book, we will be pointing out chord progressions in the same way. You will find that some producers like to use a ii-V-I at the end of their progressions, while others like to use vi - IV - I. Knowing how those sound, and what we like to hear, will help us to decide what kind of progressions we want to use in our own music. ►

*This system of roman numerals is slightly different than what is traditionally taught in classical music theory. We will be using more of a pop-music based notation here, since it is much closer to what we need for analyzing most electronic music tracks.

14. Song Analysis: Zedd, "Daisy"

Moving forward, we are going to periodically be doing some analysis of songs. The songs we are using I've chosen because they fit the topic of the previous chapter, while still introducing something new. I'm trying to avoid using too many songs in any particular style and to incorporate as many different genres as possible. In any analysis, it is important that you listen to what is happening. That is particularly hard in a book, so be sure you are following along by inputting the notes, cueing up the track, and walking through the process step-by-step.

For this first analysis, we are only going to look at the verse of the song.

14.1 The Bass Line

Hearing what chords are in the song can be tricky. It takes practice to really be able to hear them quickly, so I like to start with the bass line. The bass line is usually a little bit easier to hear, and gives us a good clue as to what the chords are going to be.

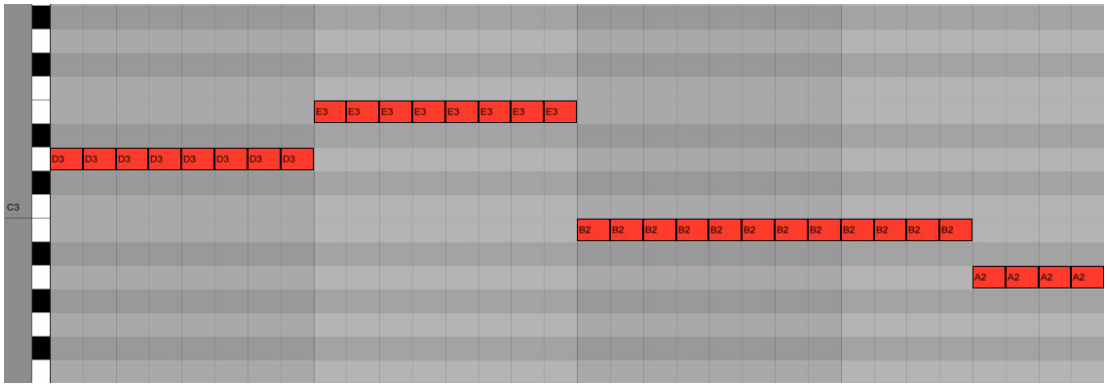
Tips for figuring out the notes of a song:
Learning how to find the notes in a song is a skill that can take years of practice. Take solace in knowing that the more you try, the better you will get at it. So don't give up!

- Start with the bass line: It is usually the easiest thing to hear.
- Loop a short section - just the individual note or chord if you can.
- Cue up an instrument with a strong attack and some sustain. I like to use an acoustic piano sampler.
- Test out notes on the keyboard and find the one that fits. In general, if you think you might have found the note, you probably haven't. When you find the right note it is usually obvious.

In this song, you can hear a bass line in the first verse that is much simpler than the one in the second verse. It isn't a bass synth, but is in the lower end of the strings at the beginning. The second verse has a bass synth that is moving around a lot. That first bass line - the more simple one - is the one we want. That will clue us in to what chords are happening.

Set that part of the song to a loop, and load up a simple sound like a piano. Start looking for notes until something sounds good. Once you find a note that seems to work, use it as a reference point to find the next note. Think: "is the next note higher or lower? If it's higher, is it a lot higher, or just a little bit higher?" Then look for the next note.

Here is what I came up with for the bass notes:


C3
E3 E3 E3 E3 E3 E3 E3 E3
D3 D3 D3 D3 D3 D3 D3 D3
B2 B2 B2 B2 B2 B2 B2 B2 B2 B2 B2 B2
A2 A2 A2 A2

14.2 Finding the Key

Next, let's see if we can figure out what key we are in. Remember, as soon as we know what key we are in, we can use the diatonic chord progression to help us narrow down what the possible "in key" chords are. That, combined with the bass line that we already know, should make finding the chords much easier.

We have four different notes in the baseline: D, E, B, and A. We need to find a scale that those will work in. It is not always true that the first note in the bass line is the key, but it's a great place to start. So let's see if the key of D works.

The notes in the D Major scale are:

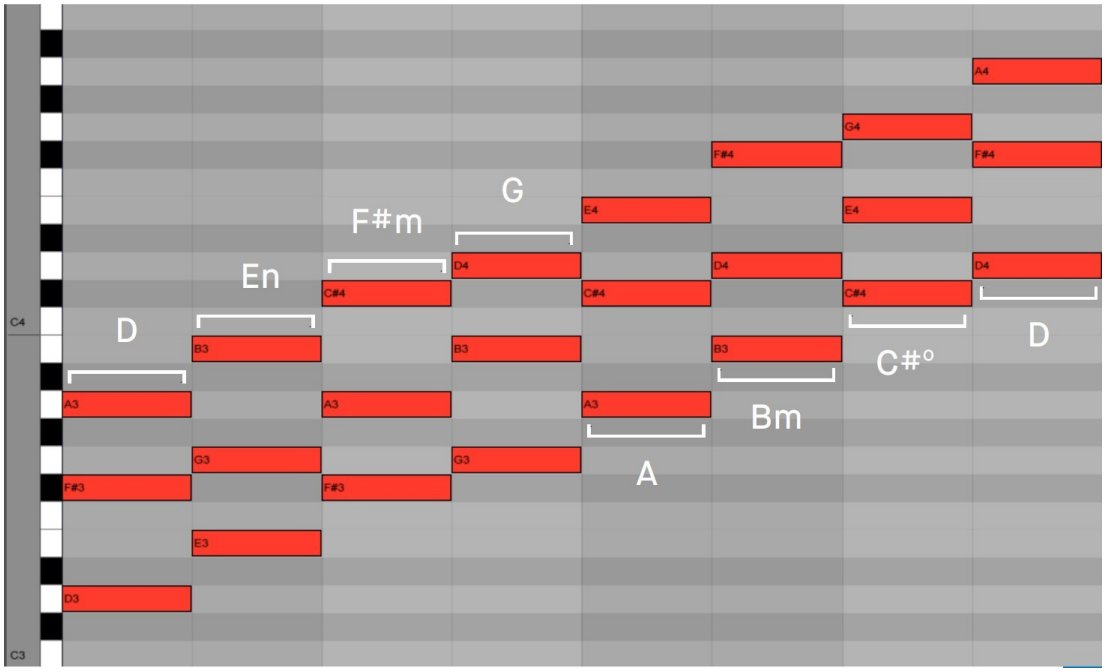
D - E - F# - G - A - B - C# - D

Do we have all the notes in our bass line in the scale? Is there a D in the scale? An E? B? A? If you can answer yes to all of those, then you have probably found the key. In this case, it's safe to say that we are very likely in the key of D.

14.3 The Chords

Before we try to find the chords, let's look at the diatonic chord progression for the key of D. If we have this in front of us, it will help to determine what chords are happening.

Remember: What we did here is take all of the notes of the scale, and apply the M-m-m-M-M-m-º pattern to it. The result is the chords we see in the diagram, also known as the Diatonic Chord Progression.



Now let's look at our bass line: D, E, B, A.

D: The chord that occurs in the diatonic chord progression is D major. That means that when the note D is the root of a triad, and all the notes are in key, the chord will be a D Major.

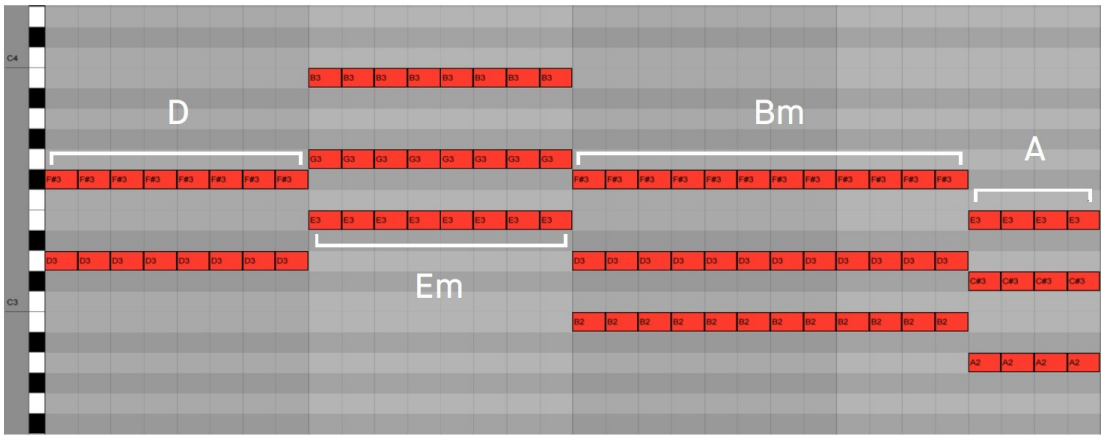
E: When E occurs as the root of the chord, it is a minor chord (according to the diatonic chord progression). So it is most likely, in this case, that our second chord is an E minor.

B: When B occurs it is also minor, so the most likely chord to happen here is B minor.

A: When the A occurs in the diatonic chord progression it is major. So we probably have an A major chord.

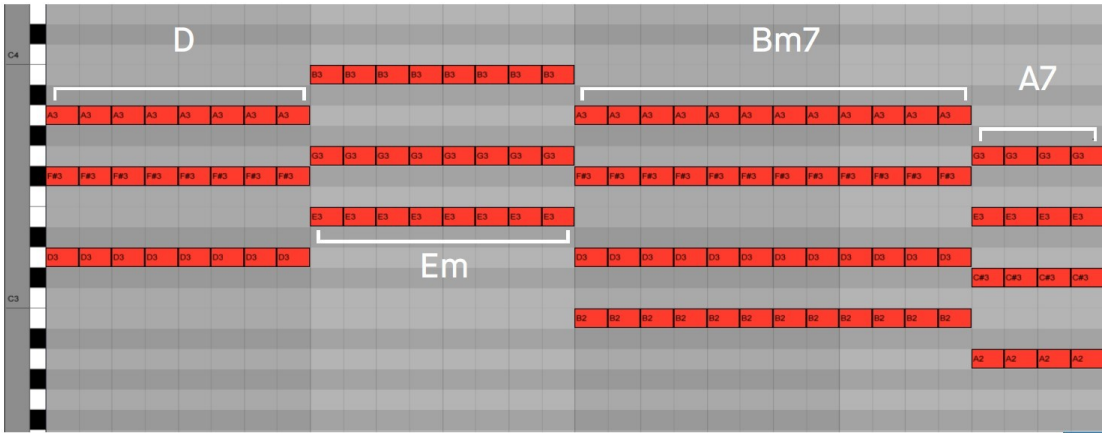
This method of finding the chords is not a sure thing. Mostly because we don't know for sure that the bass line is giving us the root of the chord. We will see tracks that do this, that the note in the bass is not the root of the chord. But in this case, it works out to be correct.

Below I've put the rest of the notes for the chord on top of the bass line.



Listen and see how it sounds to you. When you are listening, think about two things: 1) Are there any wrong notes? and 2) Is it missing something?

If you hear wrong notes, then we have something wrong with our chords. I don't hear anything wrong (and "wrong" in this situation means different from the track, since that is what we are trying to emulate). But it does sound like something is missing. If something is missing, but nothing is wrong, then most likely we should try adding a 7th to some or all of the chords.



Try adding a 7th to the last two chords. Depending on what section of the song you are listening to, you might also hear a 7th on the E minor chord. Notice that putting a 7th on the last chord gave us the dominant 7th chord. That is the chord that has the strong tendency to resolve back to tonic. And in this case, it does. When this chord progression is played in a loop (as it is in the song), the chord after the A7 is a D, making a proper resolution.

14.4 The Analysis

Now that we know the chord progression, let's take a look at the roman numerals.

I - ii - vi7 - V7

The song is in the key of D, and the form tells us that this chord progression happens in all the verses and the introduction. Now that we know the roman numerals, we can use this chord progression in one of our own tracks, if you like the way it sounds. Don't worry, it isn't stealing. You can't copyright a chord progression. ►

15. Minor Keys

So far we have focused on Major keys. We know that they are major keys because they are based on a major scale. We also know that a major scale is a pattern of half-steps and whole steps. What would happen if you changed that pattern?

Think of the major scale as a specific pattern of half-steps and whole-steps, and imagine that there are hundreds of other ways that you could arrange half-steps and whole-steps. None of those other patterns will produce a major scale, but they will all produce something. In fact there are hundreds of other scales that exist, and they are all nothing more than different arrangements of half-steps and whole-steps. We will look at some of the less common patterns in Chapter 27, but for now, let's look at the second most common arrangement of half-steps and whole-steps: the minor scale.

The most common scale you will find, other than the major scale, is the minor scale. You know this term from chords: major chords generally have a happy sound, and minor chords generally have a sad sound. The difference between major and minor keys is similar: minor keys, and songs built on minor keys, tend to be a little darker.

15.1 The Minor Scale Pattern

In order to learn the minor key, let's start with the minor scale. Remember the pattern for the major scale? It looked like this:

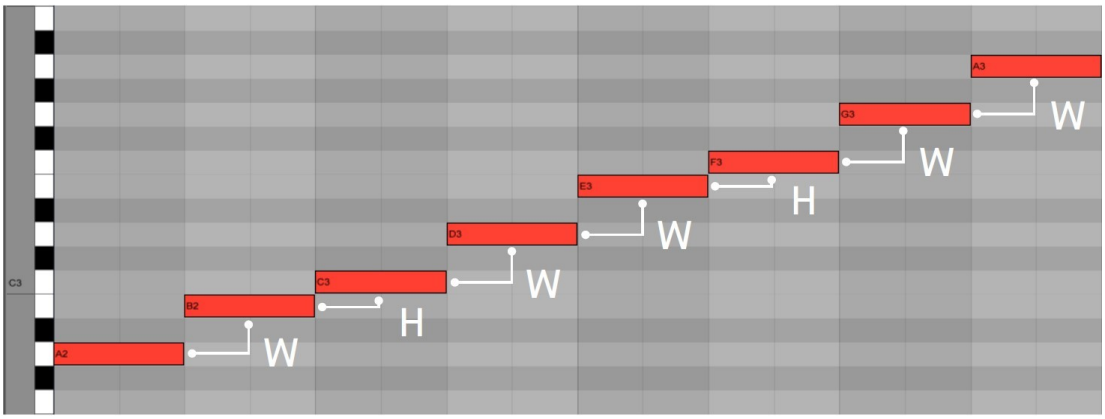
W W H W W W H

In this pattern, 'W' refers to whole-step and 'H' refers to half-step.

Everything about this is the same in a minor scale, except the order of the half-steps and whole-steps. In a minor scale, the pattern is this:

W H W W H W W

Let's look at this in the key of A minor.



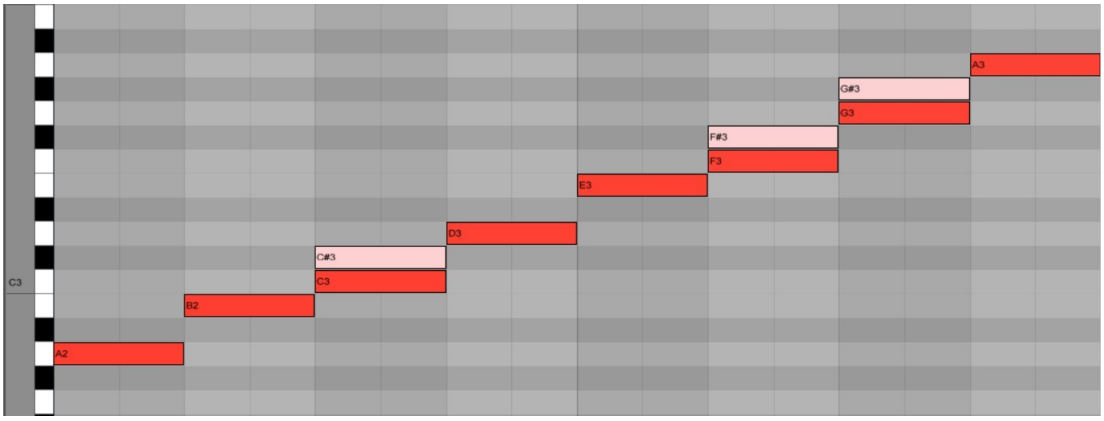
The notes of the A minor scale are: A - B - C - D - E - F - G - A.

15.2 Minor vs. Major

We can (and should) memorize the pattern of the minor scale, but there is another way to figure out the notes in a minor scale. That would be to start with a major scale, and adjust the notes that are different. There are only three notes different between the major and the minor scales.

The third is a 1/2 step lower in the minor scale. Just like how we lowered the third of a major chord to make it minor, we lower the third note in the major scale to make a minor scale. The second note that is altered is the sixth. It is also lowered by a 1/2 step. Remember that the sixth is the inversion of the third, so it also has some authority over the major/minor quality. Last, we lower the seventh a 1/2 step as well.

A minor scale can be said to be a: "major scale with a b3, b6, and b7". The graphic below shows the notes of the A minor scale, with the notes of the A Major scale that differ in the lighter pink color.



We have a special word for these two scales: Parallel. "Parallel keys" are two keys that have the same tonic, or root. In this case, A major and A minor are parallel keys, and this is true of any two keys with the same letter name. C major and C minor, F# major and F# minor, etc.

15.3 The Minor Key in Music Production

Don't think of the minor key as a key only good for writing sad or dark tracks. Just like how we can make something sound dark using a major scale, we can make a song sound happy with a minor key. Both keys are versatile in their emotive qualities.

However: It is worth noting that a small majority of tracks produced today seem to be in minor keys.

15.4 Relative Keys

If you look closely at the pattern of half-steps and whole-steps you might notice something interesting.

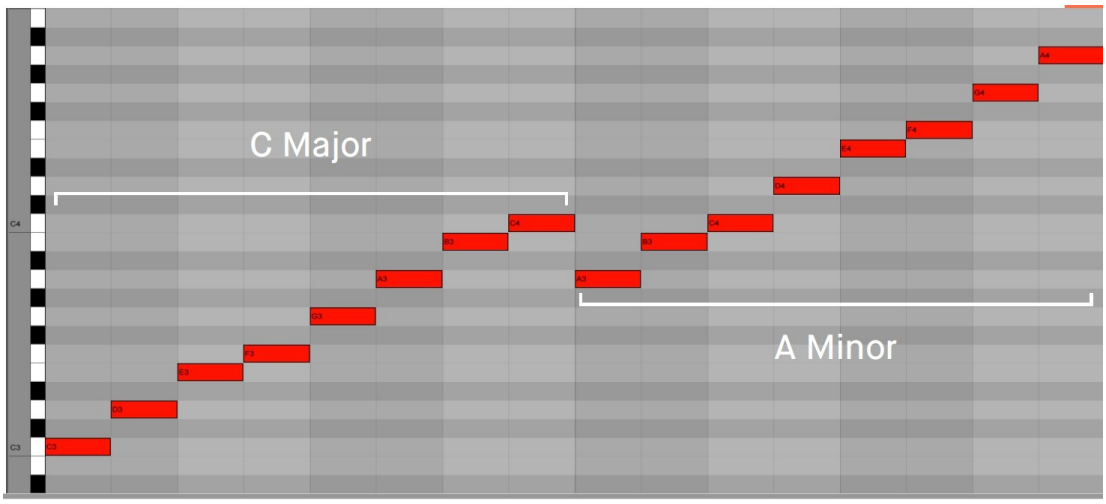
Major	W	W	H	W	W	W	H
Minor	W	H	W	W	H	W	W

If you nudge the major pattern forward a few places, it lines up. That's because the pattern of half-steps and whole-steps is actually the same between the major and the minor, they just start at different places.

Major	W	W	H	W	W	W	H
Minor	W	H	W	W	H	W	W

Every major scale has an "evil twin" that is a minor scale. These are called Relative scales. Relative scales have all the same notes, but a different tonic, or root. We hear one as major because starting the pattern at a certain place gives it a "major feel," while the other is minor because of the "minor feel" of the starting note. To find a relative scale, you just have to take the major scale, and go up to the sixth of the scale. For example: in C major, the sixth is A. That means that A minor is the relative to C Major.

C Major	C	D	E	F	G	A	B	C
A Minor	A	B	C	D	E	F	G	A

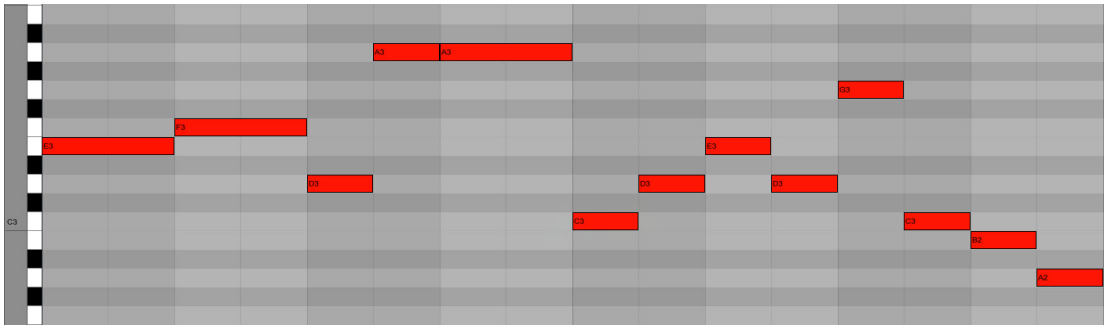


Another way to think about relative keys and scales is to simply look at the notes in each scale. How many flats and sharps are in each scale? In C major, there are none, and in A minor there are none. Therefore, they have all the same notes.

How is this useful?

You can quickly find all the notes in a minor key by remembering what the relative major key is. For example, if I wanted to know what the notes in the key of E minor are, I might just think about the key of G major (since that is the relative major key), and know that they are the same. (You can quickly find the relative major key from a minor key by going up to the third scale degree of the minor scale).

If we have two keys that have the same notes, how do we know what key we are actually in? This can be a little difficult to answer, and requires a little bit of interpretation. Let's look at an example melody.

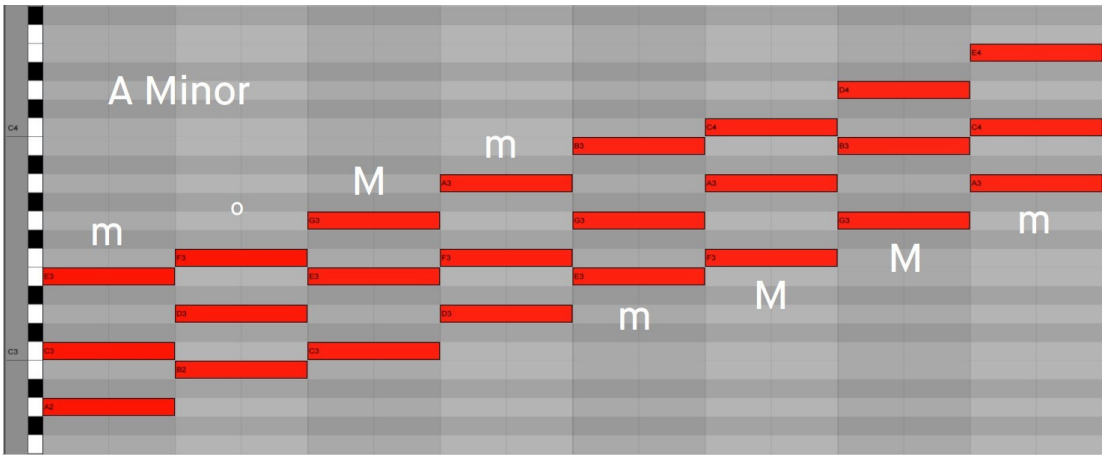


This melody is using only notes in C major (and the relative A minor). In order to determine what key it is actually in, I would first listen to it and see if it feels more like a minor melody or a major melody. Then I would try to figure out what the root is. In this case, the highest and lowest notes are both A. That is a really strong indication that it is in A minor instead of C major. You might also see if the last note, which often (but not always) resolves to the root gives you any clues. In this case, it points towards A minor. I would firmly determine this melody to be in A minor rather than C major.

15.5 Minor Diatonic Chord Progressions

When we are working with the minor scale, our diatonic chord progression is going to follow a different pattern as well.

Major	M	m	m	M	M	m	°	M
Minor	m	°	M	m	m	M	M	m



You can again see here the relative C major pattern in the diatonic chord progression. If you shift the chords in the same way we did for the scale, you get the same diatonic chord progression.

Major			M	m	m	M	M	m	°	M
Minor	m	°	M	m	m	M	M	m		

It's important to remember that the diatonic chord progression for a minor key is not the same as the major key - it is shifted. If you don't remember that, you will be using all the wrong chords for the minor key you are in!

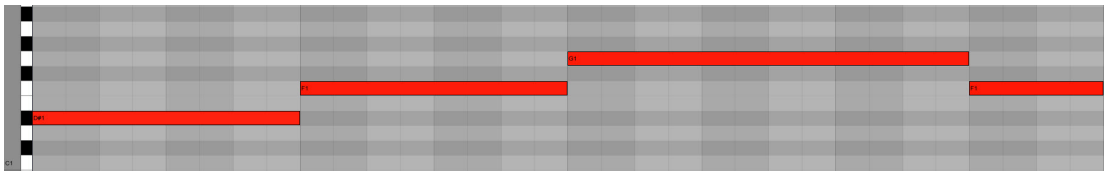
►

16. Song Analysis: Skrillex, "Scary Monsters and Nice Sprites"

In this analysis we are going to look at a song that you could analyze in a major key or a minor key. The "correct" key is debatable, but I'll make a case for this one being in a minor key.

16.1 The Main Section

Just like our previous analysis, let's start by finding the bass line. It can be a little hard to hear the bass at the very beginning of the track because it all fades in, so start the track at 0:14 to really hear it.



Throughout this section the melody (and the chords) are a repeating four-bar pattern. The bass line is mostly holding down single notes for each measure, with a shorter note at the end of the fourth bar.

Before we go any further, do we have enough information to determine our key? This is a good opportunity to try to just hear the key. Play the

example above, on a loop. Stop playing it once the first note comes around again. Does that note feel like the song could end on it? Try the second note, then the third. To my ear, the first two notes are leading up to the third note, where the song feels the most stable. That means that the third note is a very good candidate to be the key.

The third note is a G. If we check to see if the other two notes are in the key of G major, we will find that they are not. But don't forget to check the key of G minor. The notes in G minor are:

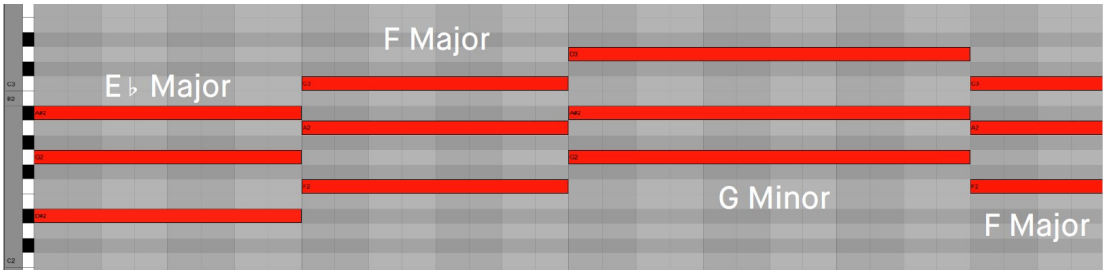
G - A - B ♭- C - D - E ♭- F - G

The other two notes of the bass line (E ♭and F) are in the key of G minor. So again, the hypothesis of G minor being our key is getting all the more likely to be true.

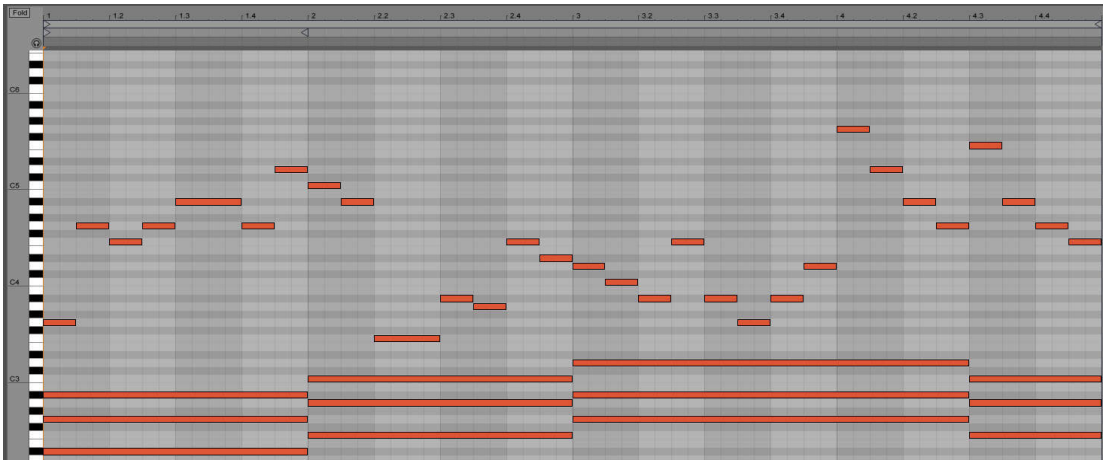
Next, let's find the chords. Remember that the diatonic chord progression for a minor key is:

m º M m m M M m

Therefore, the possible chords in the key of G minor are: G minor, Aº, B ♭Major, C minor, D minor, E ♭Major, and F major. If we assume our bass notes are the roots of the chord (which, remember, is not always true), we can try the chords E ♭major, F major, G minor.



That sounds pretty good, but if we really want to know if those are the right chords, we should make sure they fit with the melody. The melody is the higher synthesizer line. There is no secret trick for figuring out the melody in a song, but knowing the chords (and knowing that most of the notes in the melody will fit in the chord) will give us some good hints. Here is the melody on top of the chords:



If you go through the melody, you will be able to see that most of the notes in it are also in the chord - but not all. It's typical to have a melody that uses the notes in the chord that is happening, and some "passing notes" that are in the key, but not in the chord.

The melody, bass line, and chords all seem to be working here, and they all support the hypothesis of this song being in the key of G minor.

16.2 The Second Section

The B Section introduces a chopped up vocal sample, takes away the synthesizer melody, and mixes the bass and surrounding sounds a little more to the front. But the notes that are being used, both in the bass line and the harmony, are the same. You can copy and paste this chord progression over every instance of this section and it will work.

16.3 The Third Section

In the third section of this song, we get the really gnarly bass, a lot of rhythmic stutters, and extraneous noises all over the place. But what chords are happening here?

If you focus on the bass line, you will hear a lot of moving around between pitches E ♭and G, but no clear chord. You could say the entire section is just sustaining one chord (either E ♭major or G minor), but that wouldn't be entirely accurate either. We really don't "feel" a chord happening in this section. The best analysis for this section would be the notation "N.C.". Nothing too fancy here - N.C. stands for "No Chord."

16.4 Could this be in E ♭ Major?

When we are trying to determine what key a song is in, the first chord in a progression like this one is usually a good indictor. In this case, the E ♭major chord starts the chord progression and that might point us towards it as the key. Another element in this chord progression that might lead us towards thinking the key is E ♭major is the way the chords move up and down from E ♭: E ♭- F - G - F - E ♭(when you include the first chord of the loop).

If you think the key is E ♭major, then the diatonic chord progression we used to figure out the chords would mostly still have worked. We would have ended up with E ♭Major, F minor, and G minor.

So our second chord would be minor instead of major. If you hear that, you will notice that it clearly doesn't sound right.

Sometimes the key can be hard to tell, but after all is said and done, remember that your ear is the deciding factor. Always listen carefully to the note you think is the key and make sure that is the note (or chord) with the least amount of tension, and it feels fully resolved to end on. ►

17. Minor Scale Variations

Unlike the major scale, the minor scale has a few variations that have become acceptable over the last few centuries. These modifications serve specific purposes and can be used to create new and interesting chord progressions.

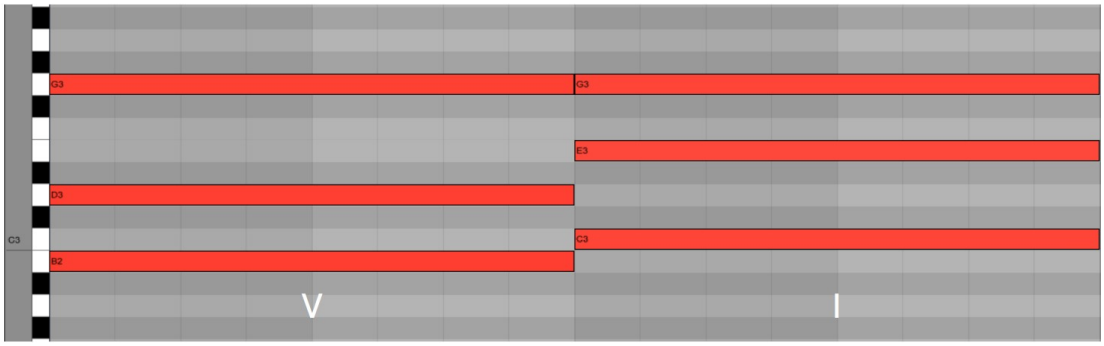
17.1 The Ripple Effect

Because of the way the diatonic chord progression works, when we change just one note of a scale, it will affect at least three different chords. Every note in the scale happens three different places in the diatonic chord progression: once as the root of a chord, once as the third of a chord, and once as the fifth of a chord. If you are working with 7th chords, then an alteration to a scale will affect a fourth chord as well: when the alternated note is the 7th.

For that reason, we need to re-look at the entire diatonic chord progression whenever we are changing even a single note in a scale. In this chapter we are going to look at changing a few notes in the minor scale, and how they impact our chords. Before we do that, however, let's take a step back and talk about fifth-related chords.

17.2 Fifth-Related Chords

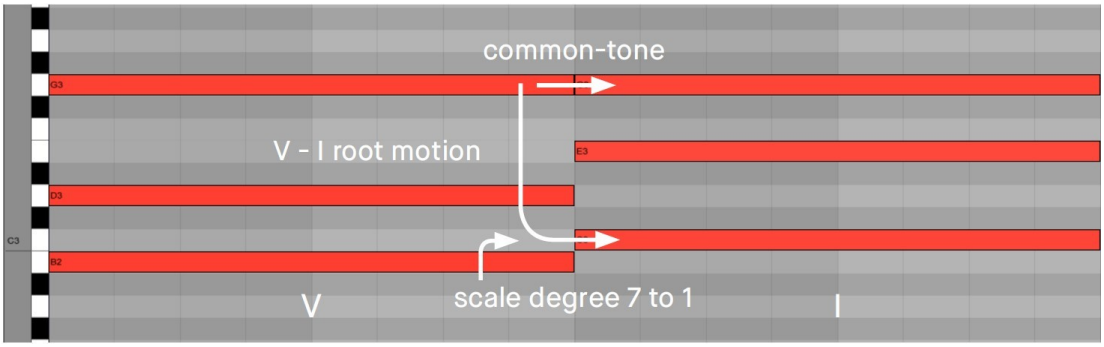
One of the most important relationships between chords is the 5th relationship. That means that we really like hearing chords that are related by fifths. V to I, vi to ii, ii to V, iii to vi - all of these are great to use in chord progressions, but nothing is stronger than the V to I chord progression. We've seen already how having a V - I chord progression helps to establish the key, end a song, and it just sounds good. Let's take a quick look at why.



In this image I've put the V chord in an inversion that puts the third of the chord on the bottom. By doing this we can see a few special properties of the V - I relationship.

First, we can tell it has a common-tone between the two chords: the pitch G. Having a common-tone makes the chord move smoothly from one to the next. This is true in all chords with common-tones. Also in this two-chord sequence, although harder to see, is a singlenote V - I motion between the roots of the chords. The pitch G moves down to the pitch C, which is the relationship of a fifth. The scale degree five to one motion here helps the chord progression feel strong and final.

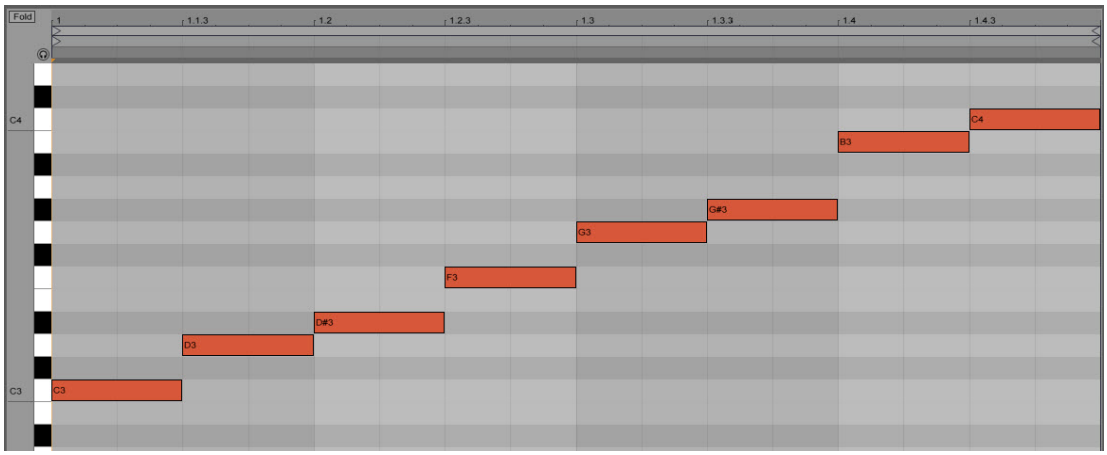
Most importantly, this progression has our 7th scale-degree in it. Remember that the 7th is our most unstable note with the strongest tendency to move, and it wants to move up to the tonic. So the B in our V chord above has a strong pull to move up to C - the tonic of the next chord. This is the main reason that the V - I progression is so common and so strong.


common-tone
G3
V - I root motion
E3
D3
C3
B2
V
scale degree 7 to 1
I

17.3 The Harmonic Minor Scale

All of the above works great, and the V chord does exactly what it's supposed to do when you are in a major key. But when you are in a minor key, the fifth chord of our diatonic chord progression is minor. The minor v chord still has the 7th scale degree in it, but it is a half-step lower, and therefore has a much weaker tendency to move up to tonic. The minor 7th scale degree is not nearly as strong, and that means the minor v - i chord progression is less fulfilling to the ear.

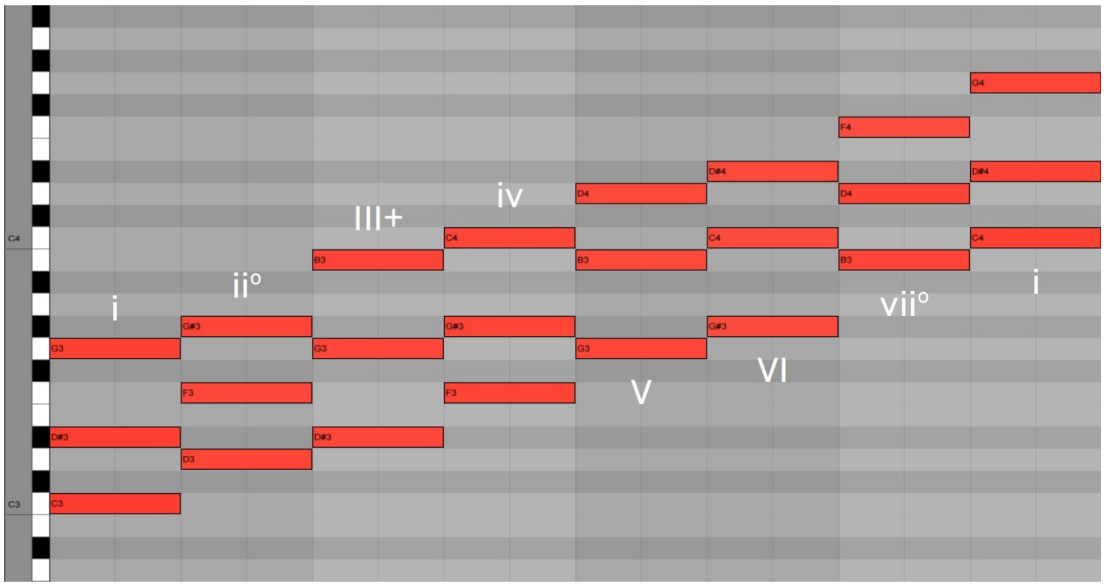
For that reason, over the years composers and producers have started to modify the minor scale in such a way that makes for a major V chord. We do that by simply raising the 7th scale degree. We call this version of the minor scale the Harmonic Minor Scale.



The harmonic minor scale is nothing more than a minor scale with a raised 7th scale degree. In the example shown here, we have a C minor scale,

which should have a B ♭in it, but it has been raised a half step to make a C harmonic minor scale. One thing you might notice about this scale is that it breaks the rule we've had about our scales up until now: that they are alternations of half-steps and whole-steps. This scale has a gap bigger than a whole step in it, between the 6th and 7th scale degree. By raising the 7th scale degree we've created a gap of a minor third - and that's okay.

Now let's take the harmonic minor scale and run it through our diatonic chord progression. Remember that a single note modified in the scale will ripple through the diatonic chord progression and cause three chords to change.



The minor diatonic chord progression, using a natural minor scale (the unaltered version of the minor scale) is m - º - M - m - m - M - M - m. The three chords that are effected by the alternation of the 7th scale degree are the third chord, the fifth chord, and the seventh chord. The three new chords include one chord we've never seen before: an augmented chord (notated with a plus symbol.)

Minor	m	°	M	m	m	M	M	m
Harmonic Minor	m	°	+	m	M	M	°	m

17.5 Chords in Harmonic Minor

Using the harmonic minor scale, the third chord in our diatonic chord progression has been turned into an augmented chord. The other two chords that have been altered are the fifth chord and the seventh chord. The fifth chord did exactly what we wanted: went from minor to major. This will give us our major V to i chord progression that we've been looking for. The last chord that was altered is the seventh, which has turned into the familiar diminished 7th chord that we find in a major key.

17.4 The Augmented Chord

You can think of the augmented chord as a sibling of the diminished chord. Whereas the diminished chord is a sort of "super minor" chord, the augmented chord is a sort of "super major" chord.

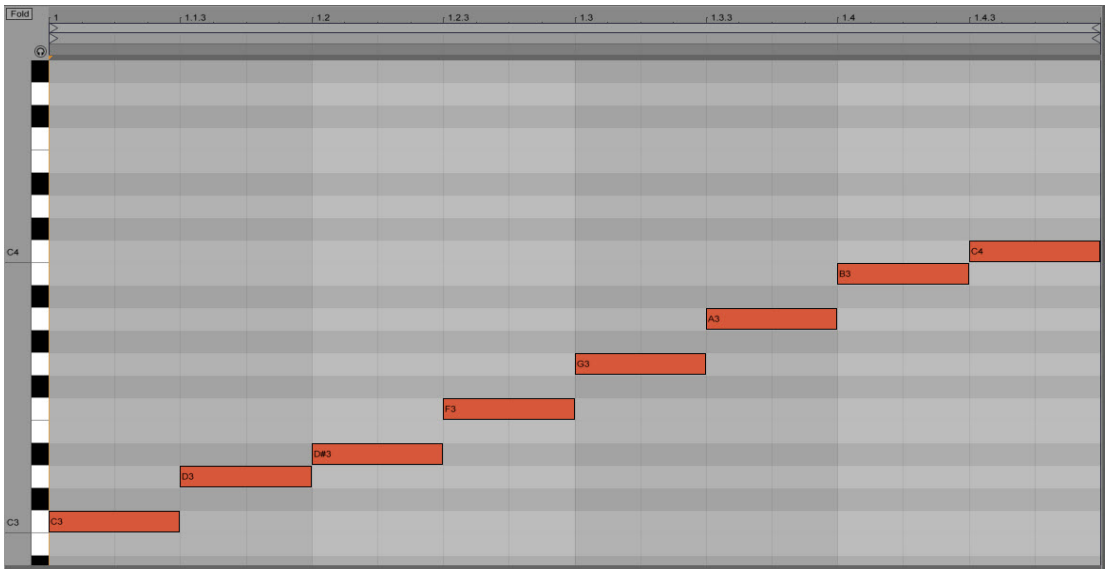
Remember back when we learned what triads were, we learned that each triad is made up of two thirds: a major third and a minor third. In a major triad, the major third is on the bottom and the minor third is on the top. In a minor triad, the minor third is on the bottom and the major third is on the top. A diminished chord breaks the rule by having a minor third on the bottom and the top, and no major third. Similarly, an augmented triad has a major third on the bottom and the top, with no minor third at all.

So far, augmented chords have not happened anywhere in a key. They only appear once you start altering notes, like we've done here in the harmonic minor scale. They have a similarly harsh sound to diminished chords and if you are writing in any popular music style you should avoid them.

17.6 The Melodic Minor Scale

There is another modification we make to the minor scale called the Melodic Minor Scale. As the name implies, this one is typically used to help a melody, and isn't as common for building chord progressions.

In the melodic minor scale, we raise the 7th scale degree (just like the harmonic minor) and also raise the 6th scale degree. The purpose of this scale is to help a melody lead to tonic in a minor key. Remember that the lowered 7th scale degree in a minor scale has less of a tendency to move to tonic, so in a melody we might want to have that note raised for a stronger tendency towards tonic. However, doing that makes a big gap we saw in the scale (that was pointed out in 17.2 above). In a melody, that gap really calls attention to itself and can have an off-putting sound. In order to avoid it, we can raise the 6th scale degree as well.



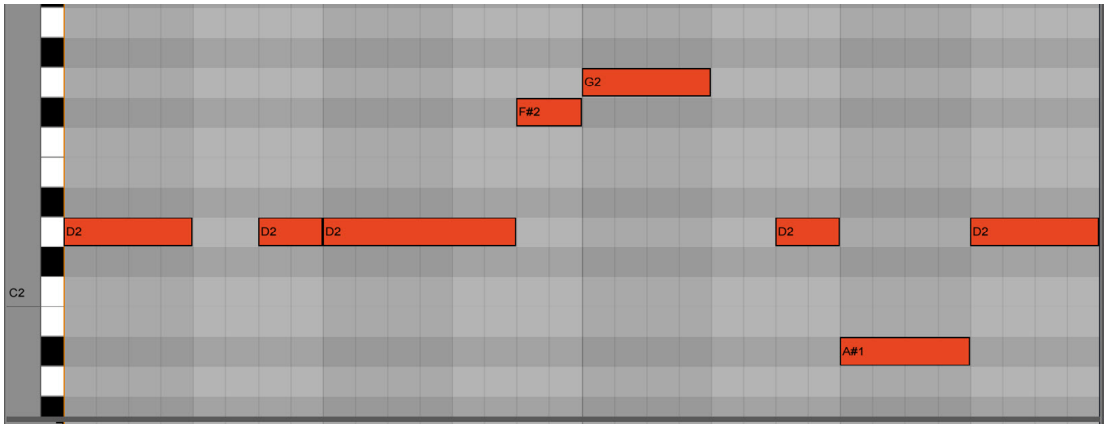
One thing you might notice about this scale is that it is very close to a major scale. If a minor scale is just a major scale with a lowered third, sixth, and seventh, and in the melodic minor scale we raised the sixth and seventh back up, then the only note different from the major scale is the lowered third. Even so, this is still a minor scale because, just like in triads, the third is the determining factor. ►

18. Song Analysis: Noctuary (Bonobo)

This is a dense song with a lot of nuance happening throughout the track. Harmonically, however, it's very simple with a repeating chord progression that continues through the entire song.

18.1 The Bass Line

Let's focus on the section right when the beat enters in the track at 0:44. In this section we hear the chord progression and the bass line in its most clear and undisturbed form. Like most of the song, the bass line is constantly changing, but is usually in some variation of this pattern:



So far we've been able to find a chord for every note in the bass line, but that isn't always true. The bass line doesn't have to only play the roots of chords. In this case, there are two chords that happen while this bass line repeats. So how do we explain the other notes that the bass line is playing?

18.2 Passing Tones & Arpeggios

Listen to the bass line again, and think about the bass notes you hear at the moment the chords change. If you listen close, you can hear that there are two main bass notes that the rest of the notes revolve around: D and G. The first bar is almost entirely the pitch D. Right at the end of the first bar, however, we get an F#. The F# is very short, and a chord change doesn't happen at the same time. It's a lone wolf.

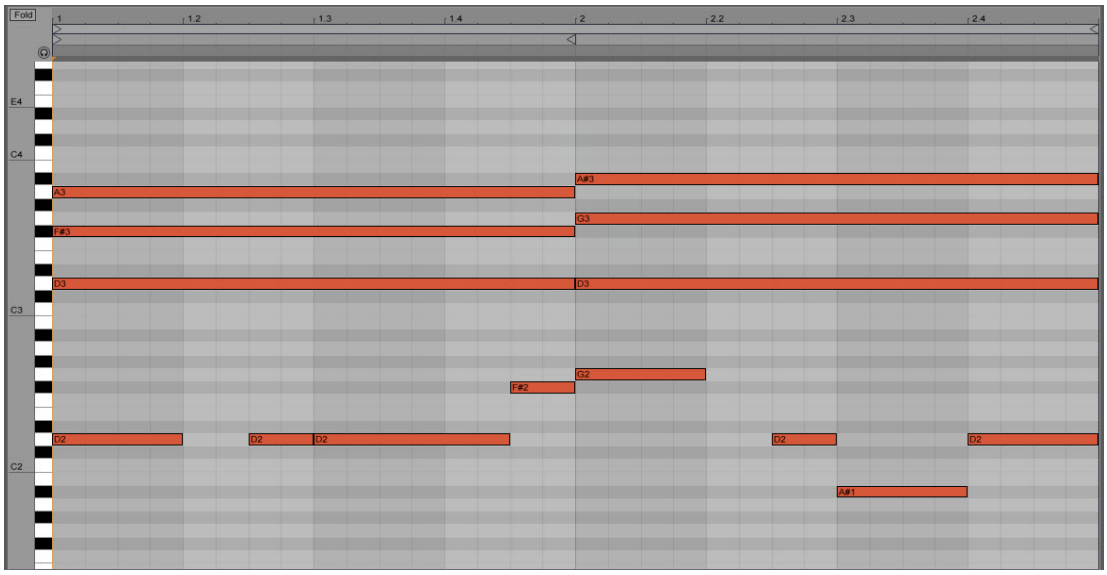
We have a name for these types of notes: Passing Tones. We briefly looked at these during the Skrillex analysis. A passing tone isn't in a chord, but is in the scale. It's a note that is inkey that we use to pass in between two (or more) notes in the chord. In this case: the F# is functioning as a passing tone leading into the G. It helps to push us up to the G. If you listen close, you can almost feel it "leaning in" to the G just after it.

There could also be a second interpretation of this note. If that note is in the chord that is sounding, then it is just another note in the chord. If a D major chord is our chord in this first bar (it is), then this is the third of the chord. It isn't out of the ordinary for a bass line to individually play the notes of the chord like this, and we even have a special word for it: Arpeggio.

When you play a chord as individual notes, one at a time, we call it an Arpeggio. Let's look at the second measure. The pitch G happens, followed by D, then A#, then D again. Could all of those notes be a chord? If we change the name of the A# to B ♭(see Section 2.8), then we have the pitches G, B ♭, and D. That's a G minor chord. So the second chord here is arpeggiating a G minor chord. We will look more at arpeggios in chapter 21.

18.3 The Chords

After analyzing the bass line, the chords are becoming more obvious: the first bar is a D major chord and the second bar is all a G minor chord.



18.4 The Analysis

Knowing that the chords are D major and G minor is a good start, but we haven't decided on a key yet. It is most likely to be either D or G minor. So which is it? Let's try the process of elimination using our diatonic chord progressions.

Chords in D Major: D - Em - F#m - G - A - Bm - C#º - D

Chords in G Minor: Gm - Aº - Bb - Cm - Dm - Eb - F - Gm

In the key of D major, we don't get a G Minor, we get G major as the IV chord. So that doesn't seem likely. If we are in the key of G minor, we don't get a D major, we get a D minor. So neither of these look like great options. However, let's consider the harmonic minor scale for the G minor. Remember that using the harmonic minor scale makes our normally-minor-v chord a major V chord. In that case, we would have G minor as the key, and the D chord as the major-V, altered because of the harmonic minor scale.

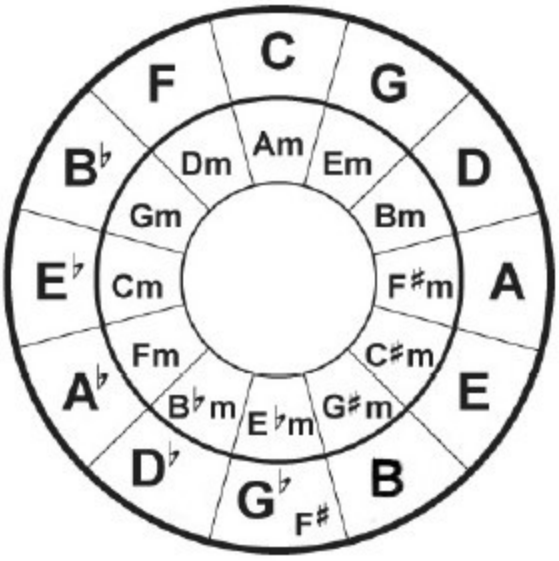
i - V

19. The Circle of Fifths

You might have seen this image before: a wheel with each note as a spoke. It might have been hanging in your school music classroom, or your local music store. This diagram is not just to hang on your wall - it is a profoundly useful tool for producing and songwriting. Especially when you are working on a song and there are no chords that sound perfect. We can look to the circle of fifths for other options and ideas.

19.1 What the Diagram Shows Us

There are a lot of variations on the typical circle of fifths diagram. Here is one that is relatively simple.



What we see here is each key in two rings, major on the outside and minor on the inside. For every key, this diagram also shows the next nearest keys. "Nearest" in this sense does not mean alphabetically, but harmonically; nearest is interpreted as "how many notes are in common?". For example, look at the very top of the circle and find C. Remember that the key of C is all white notes (C D E F G A B C) - there are no flats or sharps. To the right of C is G. The key of G major has one sharp in it. That means that there is only one note different between the key of C and G. If we look to the left of C we see F. The key of F major has one flat in it, so it is also only one note different than the key of C. In the same way, C major is very different from G-flat major (Gb Ab Bb Cb Db Eb F), which is why it's WAY over on the other side of the diagram.

We call this the circle of fifths because it turns out that the closest possible key is always a fifth away. If you start on C, and count up to the fifth note of the scale you get G - the next note to the right. If you count up to the fifth note in the key of G you get D, the next note to the right. All the way around you will get the fifth note of the scale. Hence, the "circle of fifths."

Because of this, the circle of fifths has become an effective way for students to memorize the number of sharps and flats in a given key. But it can also help us to write more interesting music.

19.2 Writing Outside of the Key

You might have been in the situation before when you have a chord progression, and you are looking for one more chord to go in it, but nothing sounds right. You have an idea in your head of the sound you want, and you go through all your possible chords using the diatonic chord progression but nothing clicks. You need something else.

Remember that the diatonic chord progression is a great place to start to find the available chords in the key, but it isn't the end. The key you are in does not need to bind you. You can go outside of the key and explore more chords. As the songwriter, you have ultimate authority. If you find a chord that is outside of the diatonic chords, but you like the way it sounds in your track, you should absolutely use it.

However, this leads to another problem: the diatonic chord progression took all the hundreds of possible chords and narrowed them down to seven that we could use, making the process much more simple. If we take that away, we once again enter the process of picking any of hundreds of potential chords with no rhyme or reason. This is where the circle of fifths can help.

19.3 Changing Keys

A lot of students have asked me how to change keys in a song. My response is always the same: I don't think you really want to do that.

It's very rare to change keys in a song, especially in electronic music or even pop music. What is much more common is to have a new section of a song with a different chord progression. For example, if you are in C major, and using the chords C, G, Am, and Dm and you want to have another section of the song, try finding another chord progression in the same key with a few chords that are in both keys. Something like G, Em, F, Dm. Now you've made a change in your song without changing keys. You just changed the chord progression.

If you want to actually change keys, the circle of fifths can help you. The closer the new key is on the circle of fifths to your original key, the smoother the key change will be. Changing keys between C major and G major can be done relatively smoothly, while changing keys between C major and F# major will be very abrupt.

19.4 Modal Borrowing

Let's say we have a chord progression in A major. The chords we are using so far are A major, E major, and C# minor. They would be I - V - iii in C major. In this example, we want to add one more chord to our progression, but none of our diatonic chords sound good to you. You want something a little different.

In order to find a few more options, we can go to the next nearest key and look at all the possible chords it has. The diatonic chord progression for closely related keys will have mostly the same chords, but a few chords not in the key we are in. For this example, I'll move right on the circle to the key of E major.

The possible chords in A major are: A - Bm - C#m - D - E - F#m - G#º - A
The possible chords in E major are: E - F#m - G#m - A - B - C#m - D#º - E

If we line up the E major chords to start and end with A, we can clearly see the chords that are different:

A major are: A - Bm - C#m - D - E - F#m - G#º - A
E major are: A - B - C#m - D#º - E - F#m - G#m - A

The chords that are different are:

- The B chord: It's minor in the key of A major, but major in the key of E.
- The D chord: It's major in the key of A major, and D# diminished in the key of E major.
- The G# chord: It's diminished in the key of A major, but minor in the key of E major.

Going back to our chord progression of A major, E major, and C# minor, we can look at one of those chords from E major that are different from A major for something outside of the ordinary. Using a B major might be interesting, as would using a G# minor chord. The D#º chord might work

as well, especially if you put it before the E major chord in the progression.

19.5 Going Further

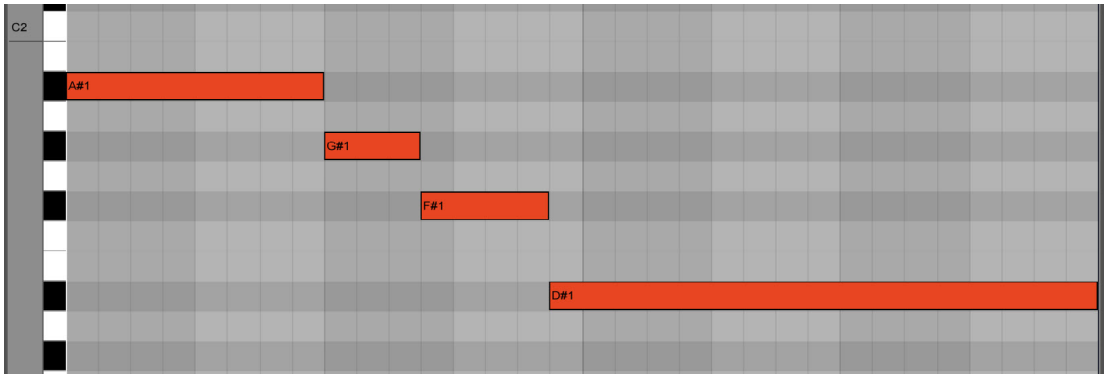
If none of those chords work, you can look at all of the diatonic chords in the next farthest away note (in this case, B major). You can also consider the chords going the other direction and looking at the chords in the keys of D major and G major.

Don't be afraid to experiment with chords from these closely related keys. This is where uniqueness and individuality really enters into the harmonies of your music. ►

20. Song Analysis: Ghosts N Stuff (Deadmau5)

This track has a number of interesting things about it. The key is a little ambiguous and it has an interesting harmonic trick in it.

20.1 The Bass Line (0:45)



The first question to ask ourselves about this bass line is: "Is there a separate chord for each note?" In this case, it sounds like there is. We can hear a chord change accompanying every bass note. Therefore we can assume each of those notes is in the chord that is happening, and it's a good possibility that these notes are the roots of the chords.

20.2 The Key

Can we figure out what key we are in just from the bass line? We only have four notes, and we don't have any half-steps. But maybe we have enough information to make an educated guess.

Let's build a scale on each bass note that we have here. The keys of A#, G#, and D# are particularly nasty in that they have a lot of sharps in them, so let's convert these to flats, which will be considerably easier.

Bass notes:	Major Scale
B♭ (A#):	B♭ - C - D - E♭ - F - G - A - B♭
A♭ (G#):	A♭ - B♭ - C - D♭ - E♭ - F - G - A♭
G♭ (F#):	G♭ - A♭ - B♭ - Cb - D♭ - E♭ - F - G♭
E♭ (D#):	E♭ - F - G - G♭ - A♭ - C - D - E♭

Whoa! What's with that C ♭ and F ♭?

I know I told that you C ♭(and B#) and F ♭ (and E#) do not exist. But they do - sort of. They exist in scales to half-step and whole-step pattern working on different notes. Remember, we can't have a B ♭ and B natural in same scale - we can only have one version of the note in any scale. So we sometimes use C ♭ instead of B natural. On a keyboard, you would play C ♭ the same place you play a B natural. The same goes for F ♭ and E.

Looking at each scale, we have one possible scale that has all of our bass notes in it: the G ♭major scale. This means that G ♭major might be our key. Before we make a decision, let's run through a little checklist of factors that influence the key:

1. Have you found a scale that all the bass notes fit in?
2. Does the song feel like a major or minor key?
3. Have you ruled out the first chord in the progression as the key?
4. Have you tried minor scales?

We've done step one, but let's think about the second step here. Does this feel major or minor? To my ear, this feels more like a minor key than a major key. If we are looking for a minor scale, maybe we should look a little closer at the first bass note: B ♭. The notes in B ♭minor are:

B ♭- C - D ♭- E ♭- F - G ♭- A ♭- B ♭

Indeed - this scale has all of our bass notes. It is also the first chord in the chord progression, so it is more likely to be our key than G ♭major, even though those notes fit as well.

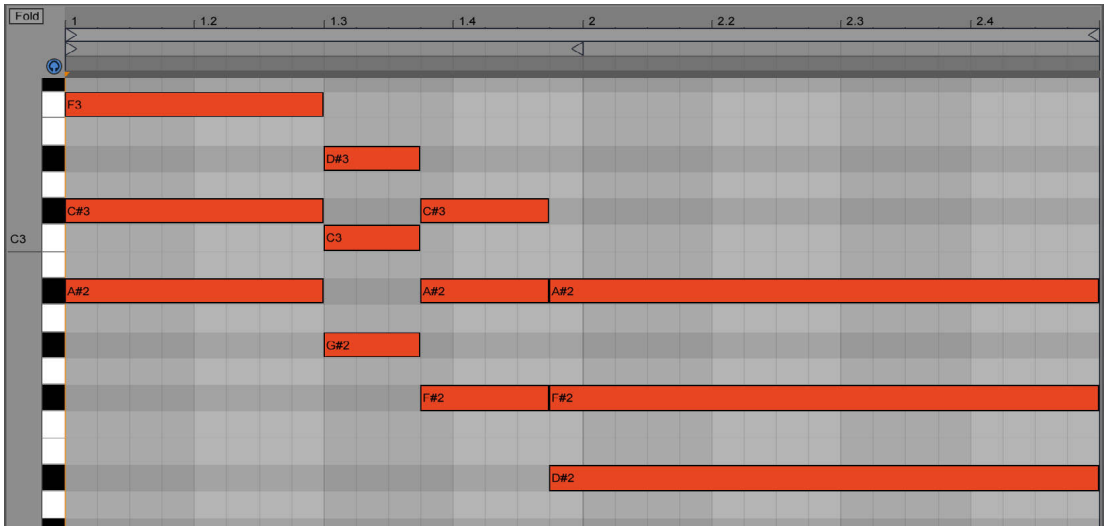
20.3 The Chords

The chords in the key	B ♭ minor	C°
of B ♭ minor are:	D ♭ Major	E ♭ minor
	F minor	G ♭ Major
	A ♭ Major	B ♭ minor

The next step is to assume each bass note is the root of the chord, and listen to the chords and see if it works.

How does it sound?

Listen close, and see if you can identify what doesn't quite fit.



20.4 What is Wrong Here?

Something about that last chord isn't quite right. What we have so far is:

i - VII - VI - iv

Let's try switching that last chord to a major chord - a major IV chord. We would do that by raising the F# (G ♭?) to a G. It's hard to hear the track because of all the distortion on this synthesizer, but I think we are hearing a major IV chord here - E ♭major instead of the chord that is in our key: E ♭minor.

That's out of key - but can we explain it with borrowing using the circle of fifths? If we go one step up on the circle of fifths from B ♭minor we get to F minor.

The chords in F minor are:	F minor	G°
	A ♭ Major	B ♭ minor
	C minor	D ♭ Major
	E ♭ Major	F minor

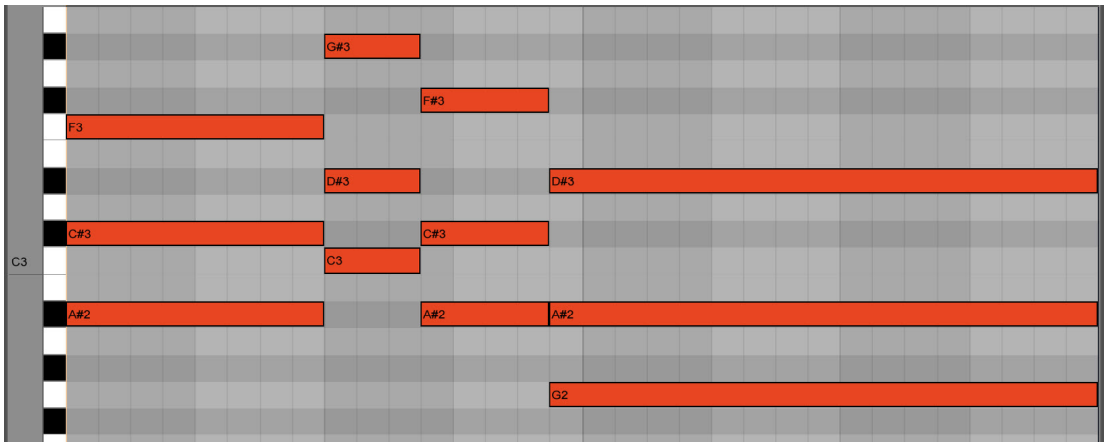
In this key, E ♭is major. So it makes sense that we would dip over into F minor to "borrow" the E ♭chord and bring it back to B ♭minor, thereby making a major IV chord instead of a minor iv chord.

20.5 Don't Forget About Inversions

There is one more thing that doesn't sound quite right in our chords so far. We can hear that the second chord is "higher" than the first. The shape of the melody in the chords goes up then back down. Our chords just go down.

We can fix that by experimenting with inversions. Move the bottom note of the second, third, and fourth chords up an octave, and you have something that sounds a lot more like the original track. That changes our bass line, but remember that there is a separate bass synthesizer still playing the bass line as we originally had it. We are just changing the chords here - not the bass line.

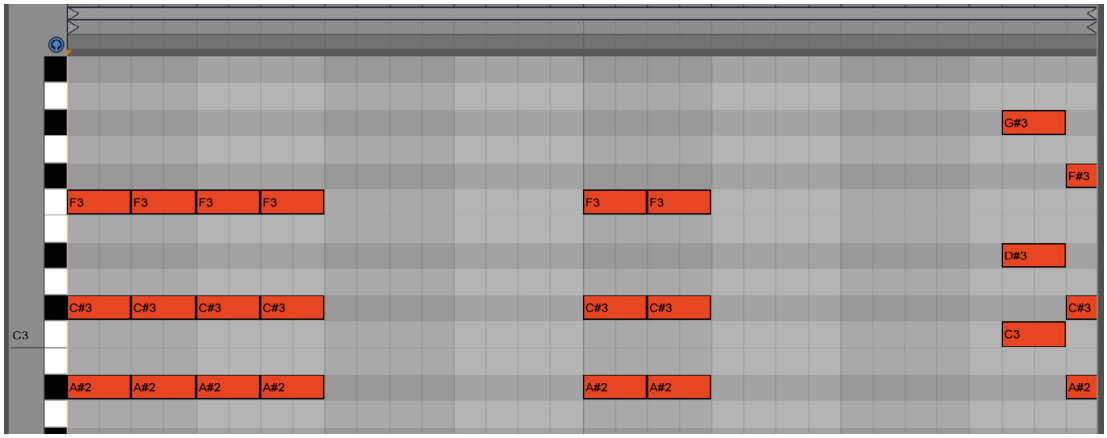
The final result looks like this:



20.6 The Second Section

What I hear in the other section of the song is fairly common for a track like this. It's playing around with the chords we've already used, and doesn't incorporate any new chords. Songs like this (and most songs, actually) are fairly utilitarian: they like to make a lot of use out of a small amount of material.

In this section of the song I hear the first chord (B ♭minor) being used for the majority of it, with occasional hits from the second (A ♭Major) and third (B ♭Major) chords. Those hits change each time the pattern comes around, but seems to be a variation on this rhythm:



20.7 The Analysis

The main chord progression in this song sticks to the key of B ♭minor for all but the last chord. For the last chord we borrow a major chord from the neighboring key of F minor.

i - VII - VI - IV

21. Accompaniment Styles

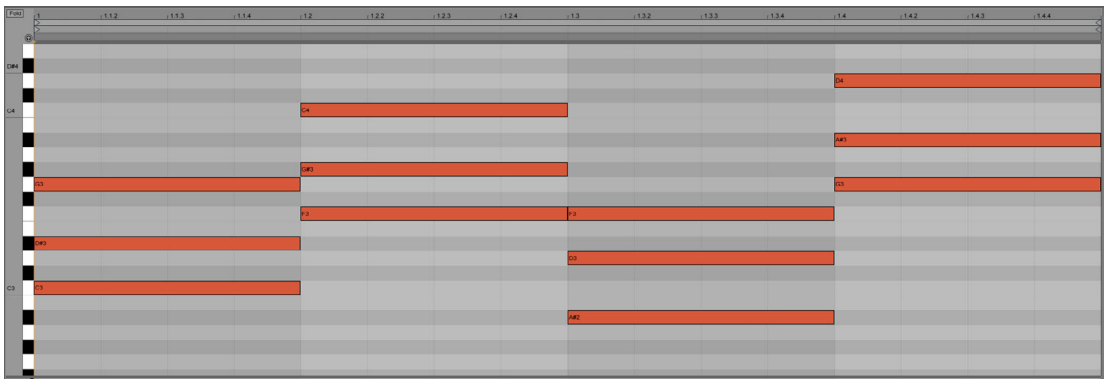
In most of the examples we have looked at so far, we've looked at the chords and the bass line together. Usually the chords have simply sustained without much rhythmic motion. It doesn't have to be that way, however. There are plenty of things you can do with a chord that will contribute to the rhythm of the song. In this section we will look at different things you can do with the chord other than sustain to give it a little more life.

21.1 Arpeggios

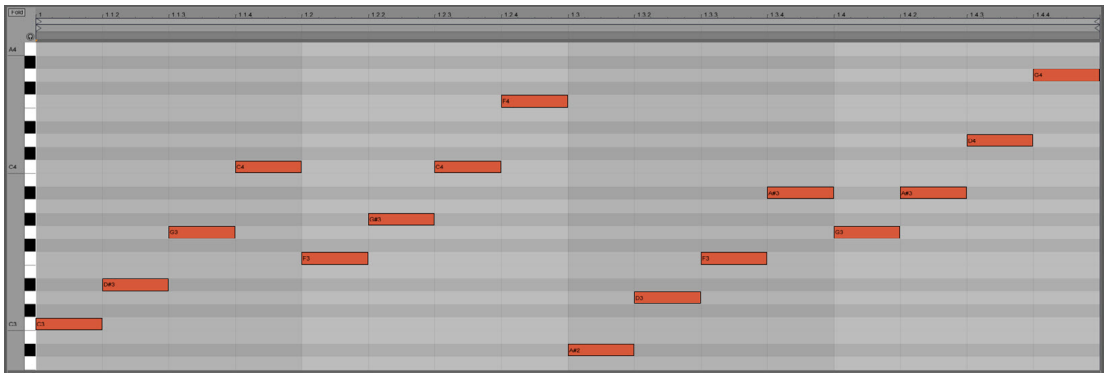
Imagine how a chord is typically played on a harp. We don't strum it, or pluck all the notes at once (usually). The notes of a chord on a harp are played one-at-a-time, as the player drags their finger across the strings. This style of playing chords has been around long enough to deserve its own name: Arpeggio (which literally translates from the Italian "to play the harp").

When we arpeggiate a chord, we play it one-note-at-a-time, usually in a consistent rhythm. Using arpeggios instead of sustaining chords can give the music more rhythm, contribute to the overall groove of the song, and still give the sense of harmony we are trying to achieve with a chord.

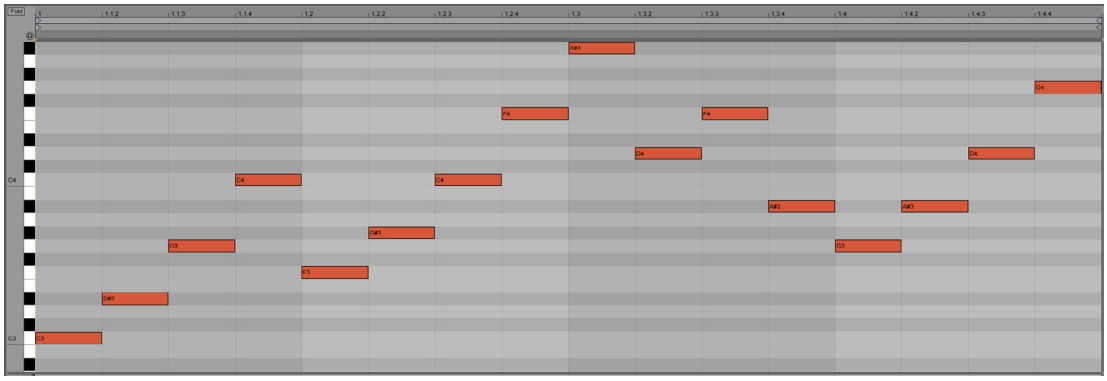
Let's use the chord progression i - iv - VII - v as an example. In the key of C minor, that would be C minor, F minor, B ♭Major, G minor.



In this example, we are just playing sustain chords, also called Block Chords: chords with no movement to them. If we arpeggiate this, we will play one note at a time. We can go up, down, or a combination of up and down. Let's arrange this going up for each chord.



Here I still have the exact same chords, except each note is played by itself, moving up through the chord. You might notice two interesting things that happened here: first, in order to make the chords line up correctly I had to add a fourth note to take up each 16th note in the beat. The note I choose to add was an octave of the root note, but I could have just as easily gone back down and used the pattern of one - three - five - three, instead of the one - three - five - one(oct) that I used here. The second thing you might notice is that this isn't entirely smooth between the chords. If you look at the end of the second chord and the start of the third chord, I have a monstrous jump of an octave and a fifth. I could smooth that out by using inversions.



What I've done in this example is break the pattern in the third chord a little bit to facilitate a smooth transition between the second and fourth chords. I put the root on the top of the chord, then let it fall down to the third, then up to the fifth, and back down to the root. It's important to note that there are really no rules to the pattern of an arpeggio. It's often nice for it to form a consistent line without too many leaps, but sometimes those big leaps can be a fun element in the music.

21.2 Automatic Arpeggiators

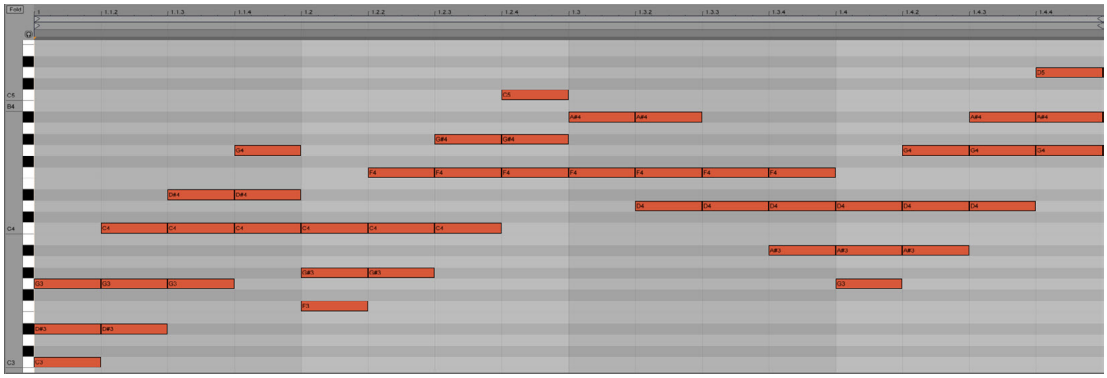
A lot of synthesizers and instruments have built-in arpeggiators. Let's take a look at the one built in to Ableton Live to see how putting this on your chord progression can give it some life.

If we put this on our original chord progression, with the block chords, it would result in one note being played at a time, just like we manually did in the above examples. There are a lot of options we have, however, to craft exactly how it determines which notes to play and when.

There are primarily two parameters that we have in any arpeggiator: speed (rhythm) and direction. In Ableton Live's arpeggiator shown here, we see speed notated as "Rate." In this image the rate is set to 1/8 , indicating an 8th note. If we wanted to match what we did in the above example, we would want to set that to 1/16, indicating a 16th note (which would be twice as fast as an 1/8th note). When it comes to direction, this is set in the "Style" menu in Live's arpeggiator. Here you can tell it to go up, down, up then down, down then up, random, and a variety of other patterns.

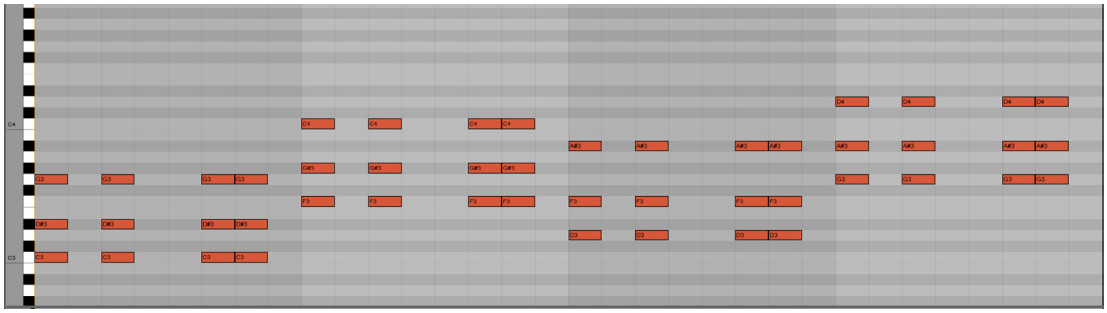
21.3 Arpeggiated Inversions

Another approach you could take for a slightly bigger sound would be to quickly move through inversions of the chords. This will sound a bit like you are playing multiple chords per measure, without actually changing the chord.



We see a lot of notes here, but it's actually fairly simple. Looking at just the first measure, we see our first chord, then on the second 16th note an inversion of that chord. The third 16th note has another inversion, and then back to the original chord on the last 16th note an octave higher. The second measure uses the same process. The third measure is slightly different in order to accompany the big leap that we encountered before. In this measure, I decided to leave the third 16th note as just two notes because repeating the top note would make it feel as though it was the same inversion as the previous inversion, and adding the bottom note would make it feel as though it is a double of the last 16th note chord. Just as with arpeggios, there are no strict rules here, so I'm free to leave a note off if it doesn't fit the sound I'm looking for.

21.4 Steady Rhythm



If you are trying to avoid using block chords and sustaining your chords, consider just giving them a consistent rhythm. If your synthesizer has a quick attack, this can be a nice texture that contributes to the overall groove of the music. Try to find a rhythm that fits well with your drums.

21.5 Alternating Bass Note Rhythms

Once we have a grasp on arpeggios and inversions, we can start to get a little more playful with our rhythms.

Again, in this example it might appear that we have a complicated pattern happening, but let's look a little closer.

We have the same four chords as the pervious examples. This time, we've punctuated each chord with two hits of a lower octave of the root note, followed by a higher attack of the chord. I've played around with the inversions of each chord in order to keep it lively and contained in a similar harmonic area.

Using patterns like this - in which we have a bass note pattern and a higher chord-inversion pattern - is a great way to fill in for a bass line when you don't have one. Consider doing something like this as an intro in a song prior to the bass coming in, then leaving out the bass notes when the full bass synth enters.

21.6 Other Standard Patterns

We've covered only a few patterns here. There are many, many more that are used so often that they've developed their own names. Most of these patterns are very stylistic, and invoke a certain feel to the song. A few others to check out include:

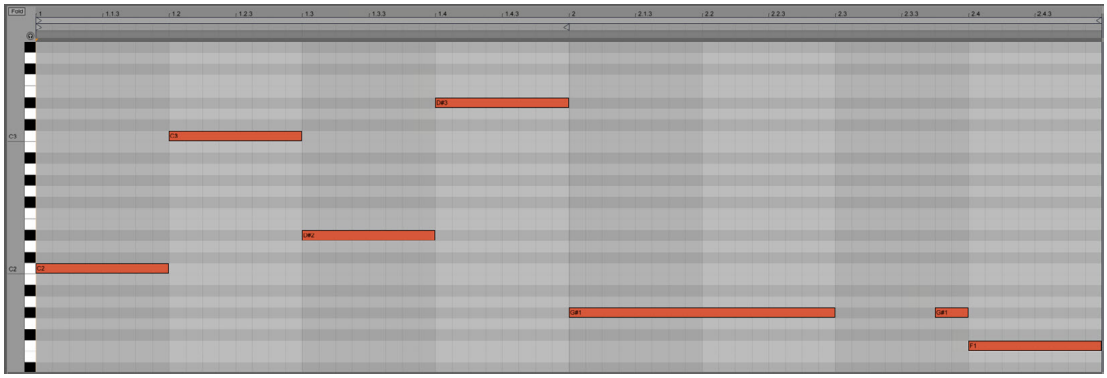
Boom Chick
Alberti Bass
Broadway
Boom Chick Broken Chord
Boogie Bass
Stride Pattern
Stretcher Pattern
Syncopations (various)
Ostinati Patterns

22. Song Analysis: Windowlicker (Aphex Twin)

Unlike a lot of the music by Aphex Twin, Windowlicker has a relatively easy repeating chord progression. What makes this progression especially fun is the rhythmic interplay between the bass line and the chords in a two-bar pattern. Let's focus on that chord progression and see if we can figure out what is going on.

22.1 The Bass Line

This bass line is a little trickier than most to hear because the second and fourth notes are high and blend in with the chord. To my ear, it sounds like we can use an octave of the previous note for those notes and it works pretty well.



If we look at the notes in the bass line we have C, E ♭, A ♭, and F. Seeing a C as the first note and its minor third as the second note really points to the key of C minor. The notes A ♭and F both work in the key of C minor, so I think that's a pretty good assumption.

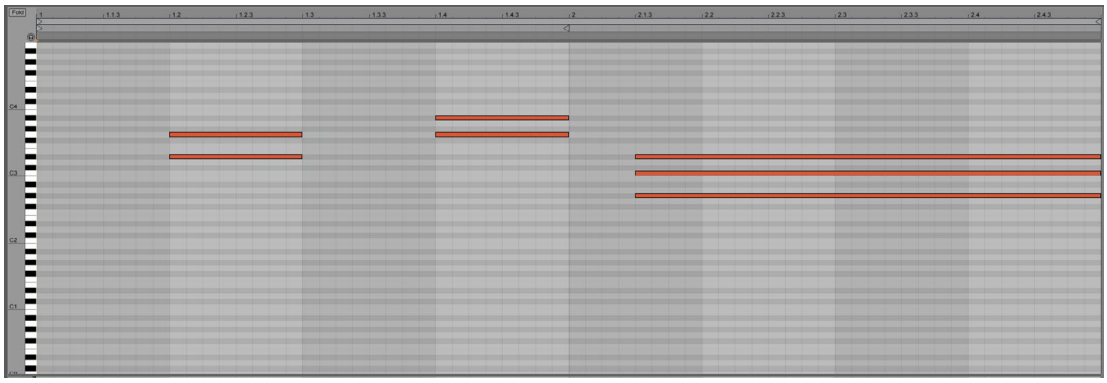
The rhythm of the bass line gives us a quick little extra step at the end, when the G# hits an extra note quickly before moving down to the F. We can also hear in the song that the chords are moving in a different pattern from the bass line. That is going to make one of these basschord accompaniment patterns in which the bass line and the chords are moving independently of each other, but work together to make an interesting groove.

Tuning?
If you are playing this bass line along with the track, you might be tilting your head sideways a little bit. Aphex has talked at length about his fondness for alternative tunings, and we can hear evidence of that here. The keyboard synthesizer in this track is tuned slightly differently, making it hard to match perfectly.

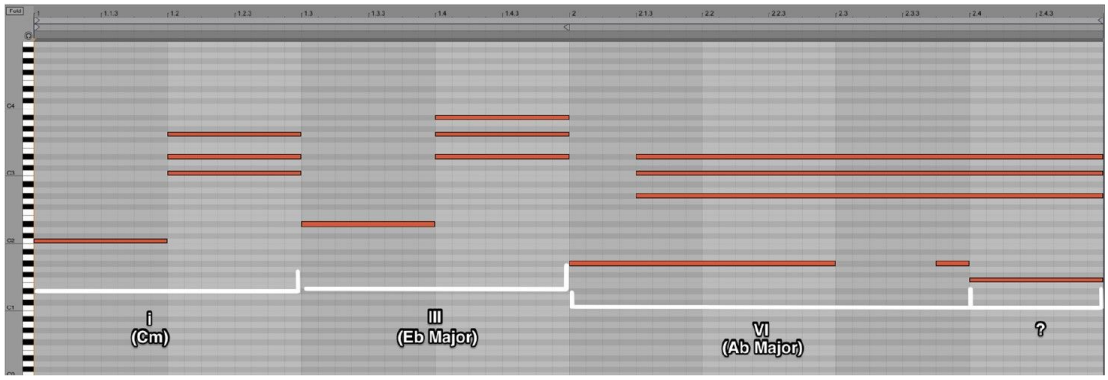
Before we look at the chords, listen to the song a few times and see if you can figure out how many different chords are in this two-bar pattern. Does each bass note get its own chord (resulting in seven chords)? Does each beat get its own chord (resulting in eight chords)? Does each two-beats get a single chord (resulting in four chords)? What about that last F that only happens for one beat alone? Does it get its own chord? See if you can make a guess based on what you hear.

22.2 The Chords

I hear three different chords happening during this pattern: one chord for the first half of the first bar, one chord for the second half of the first bar, and one chord for the entire second bar.



Each of these chords are triads, but I only have two notes for the first two chords because the third note is in the bass line. Let's look at the bass line and chords together to get the full picture.

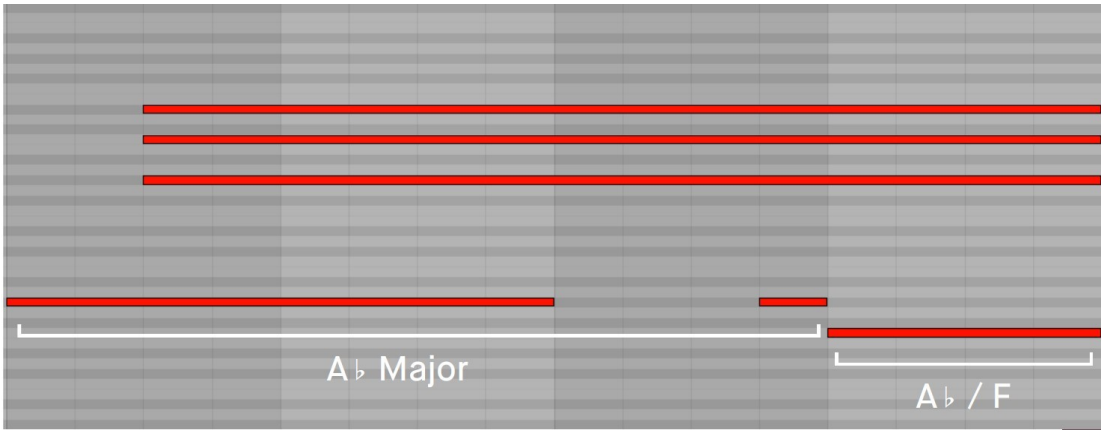


The first bass note is in the chord that follows on beat two, so we can call that all a single chord. In this case, it is C minor, which further establishes our key of C minor. The next chord works the same way: root note in the bass, then a chord on top of it. In this case, the III chord - E ♭Major. The second bar has a clear A ♭Major (VI in this key) for the first three beats, but things get a little confusing when that F comes in on the last beat.

On the last beat, we have the notes F - A ♭- C - E ♭, which does make a chord. It makes an Fm7 chord. Fm7 is in the key of Cm, so there is nothing out of key. However, does it feel like an Fm7 chord? This is where music theory can get a little subjective. There are situations in which chords are not really chords because they don't behave like chords. And this is one of them.

Think about this: for the first three beats we have an A ♭Major chord. On the last beat, and for only one beat, a single note is added. Does that completely change the feeling of the chord? Or does it feel like one note was added to an existing chord? To me, it feels like a quick addition to the chord that is already sounding.

In that case, we have an A ♭Major chord with an F in it. We could call it some kind of A ♭Major with a 6th (because F is a 6th above the root of A ♭), but there is a better option. We often see chords like this in jazz and pop songs: essentially just a chord with the wrong bass note. We have a simple way of notating it: A ♭/F. That means an A ♭chord, with F in the bass.



These kinds of chords are called "Slash Chords" and are often used at the ends of patterns like this to give the chord a little extra life after it's already been sustaining, and push the progression back to the start of the pattern.

22.3 The Pattern

Through this song we have an alternating bass-chord pattern. Later in the song there are some variations of it, particularly in the bass line, but it doesn't fundamentally change the chord progression. Adding rhythm to your chord progressions like this emulates someone playing keyboards on your track, and gives it extra life and character.

22.4 The Analysis

This song is clearly in C minor, with no borrowed or out-of-key chords. The last F in the bass line can be explained as a slash chord. It uses an alternating bass note style accompaniment pattern through the song.

i - III - VI - VI/F

23. Using Dissonance

It is sometimes said that all music is a series of tensions and releases. When it comes to chords and harmony the primary tool we have for creating tension is dissonance. So far in this book we've largely avoided dissonance, but when incorporated correctly it can have powerful results.

23.1 Defining Dissonance

Intervals of certain types can create dissonance. Keep in mind that a single pitch can't be dissonant, because dissonance refers to a sound made between two notes. For example, one of the most dissonance interval we have is the minor second. Playing two notes a minor second apart creates a very unstable sound that might make you wince a little bit. We describe this sound as "harsh," "piercing," "clashing," or any of a number of other words that tend to denote some kind of violence.

The opposite of dissonance is consonance - intervals that are easy to hear and work with, like the perfect intervals. All intervals can be put on a scale from consonance to dissonance.

Consonance	Dissonant
Unison - Octave - P5 - P4 - M3 - m6 - m3 - M6 - M2 - m7 - m2 - M7 - Tritone	

While this table is somewhat a matter of opinion, most people would agree that the perfect intervals are our most consonant intervals, and the minor second (and its inversion, the Major seventh) are nearly the most dissonant. The winner for the actual most dissonant interval is the tritone.

23.2 Diabolus in Musica

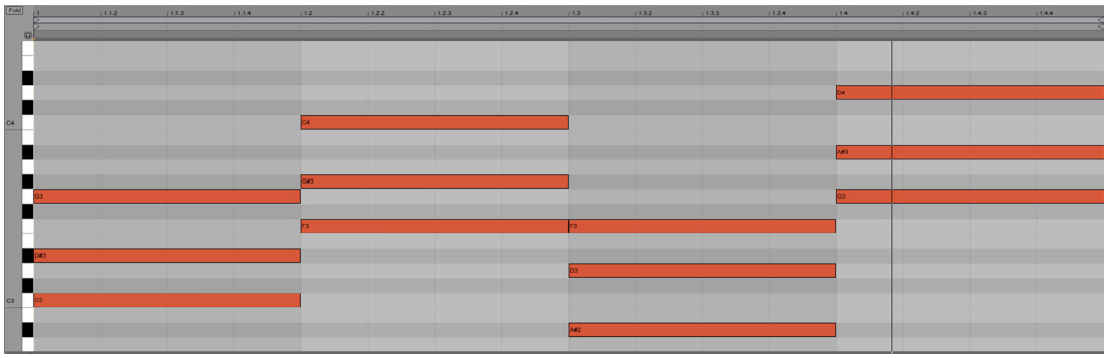
The interval of F to B is a curious one that deserves some special attention. We call this interval the "tritone," because it is made up three whole steps. The tritone is the distance from a root to a note a fifth above, minus one half-step. We can't really call it a "minor fifth" because the interval of a fifth is a perfect interval, so we have a special name for it (the tritone). This interval does happen naturally in a major scale, but not between the root and any other note, but between the fourth and the seventh.

Going back in history, you can find the tritone treated as an interval to be avoided at all costs. In early church music, the monks spent so much time trying to avoid using the tritone that it developed the term diabolos in musica (The Devil in Music). Historical accounts of people being beheaded for playing the interval have been mostly discredited, but a few accounts of punishment for invoking the tritone still hold up from the 17th Century.

To the modern-person's ear, the tritone will sound like a dissonant interval, but probably will not inspire any great pain or torment.

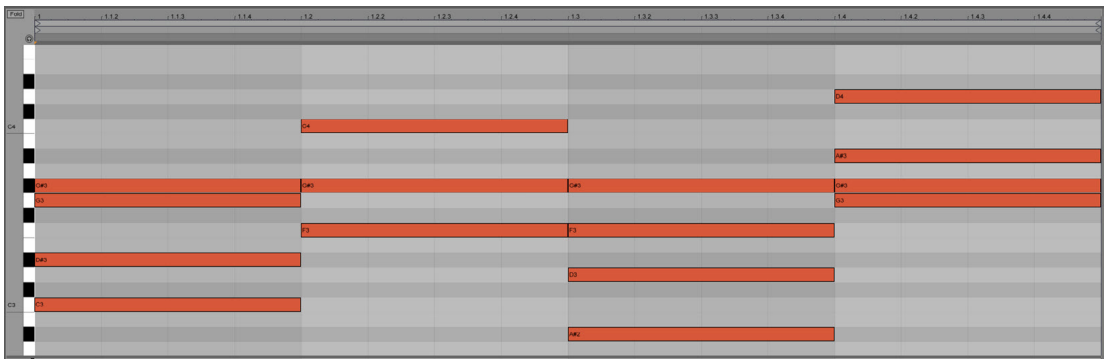
23.3 Adding Dissonance

Let's go back to the chord progression we used in chapter 21: i - iv - VII - v, in the key of C minor.

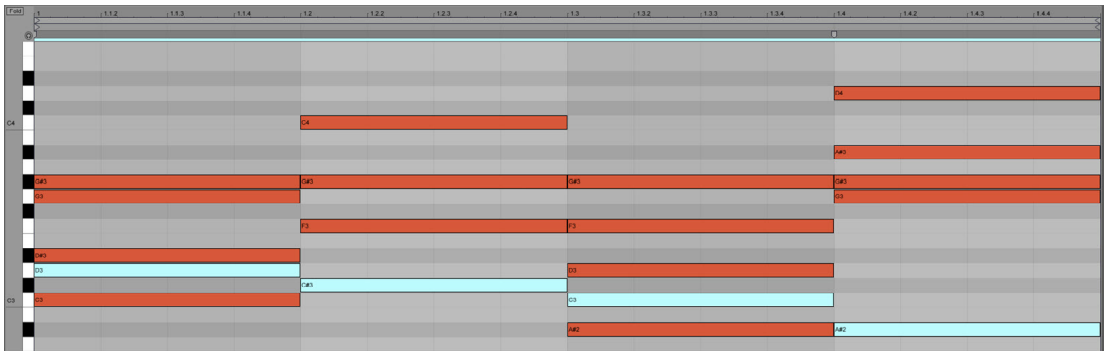


Let's experiment with creating more tension in this progression by adding dissonance. Try adding an A ♭to the first chord. That makes the interval of a minor second above the fifth of the chord - a pretty sharp dissonance. One thing I like to do when I find a note that doesn't normally belong in a chord is try adding it to all the chords. If we add that same note to the last chord, it makes a minor second between the root and the A ♭. Adding an A ♭to the third chord turns it into a dominant seven chord (which has a tritone in it - between the D and G#). We can't add the Ab to the second chord, because it is already in it.

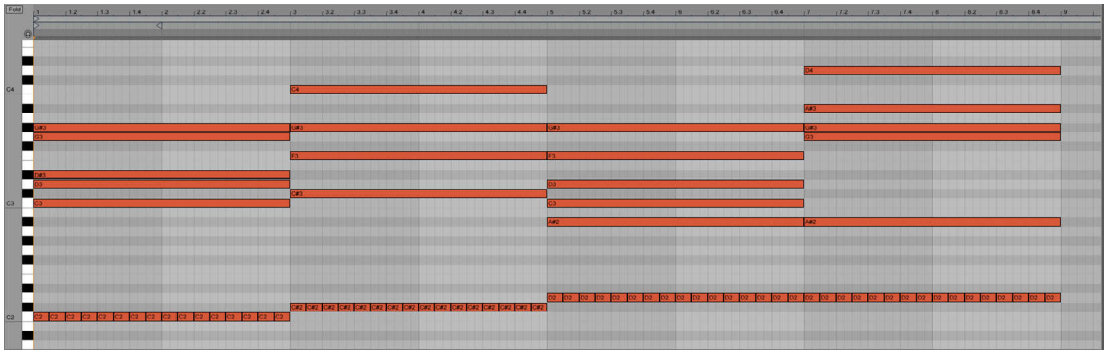
Listen to how this chord progression sounds now that we've added some dissonance.



Let's take it one step further: I'm going to add a chromatic descending line to this progression, starting with a major second in the first chord. In other words, I'm going to add a D to the first C minor chord, then move down by one half-step for every chord following it. (That puts a C# in the second chord, a C in the third chord, and a B in the last chord.) After listening, the B in the last chord is a little too much dissonance for me, so I'm going to adjust it down to a B ♭.



While all these added dissonances help to create a sense of tension, we can kick it up a notch by slowing it down and adding a repeating baseline. Try putting a pulsing bass note of C under the first chord, then C# for the second chord, and D for the last two chords. Extend the progression so each chord gets about two measures, and slow down your tempo to around 67bpm.



23.4 Prolonged Resolution

Why does dissonance create tension?

Dissonance always wants to resolve to a consonance. The tension that we feel is very literally the listener anticipating the resolution of the dissonance. In that way, more isn't necessarily better, but the longer you can keep a dissonance going, the stronger the tension and more impactful the release. That's why slowing the progression down and letting the dissonant harmonies linger for a measure or two is more effective than when we speed past it with a quick chord.

This is also true in melodies. If you have a note that creates some dissonance, the longer you stay on it, the more tension will result. We will see this clearly in the Richie Hawtin analysis in the next chapter. ►

24. Song Analysis: No Way Back (Richie Hawtin)

To demonstrate tension, let's look at Richie Hawtin's No Way Back. Despite only having a few notes in the entire track, Hawtin uses dissonance and repetition to achieve a dark, pounding atmosphere.

24.1 No Chord Progression

If we listen to this entire track - all 13 minutes of it - you might notice that at no point do you feel a sense of "shift" that we get with a chord progression. There is no chord progression in this track. There are notes happening in the song, so there must be chords, right? Yes, and no.

In a song like this we have two options: we can call the entire song a I (or i) chord. That is to say that for the entire song we are staying on one constant chord that doesn't change. There might be a note that comes and goes outside of the chord, but there is no completed second chord. Or, we could simply say this song has "No Chord," like we saw in the second part of the Skrillex track. If we don't ever change to another chord, how can we know what key we are in, and relative to that, what roman numeral to put on the chord? In other words: if there is only one chord and nothing to compare it to, are there any chords at all?

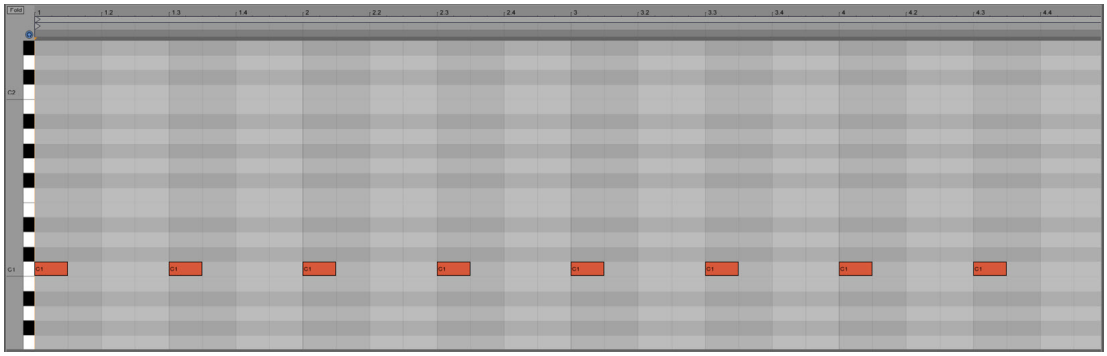
Before we get too existential about it, let's look at the notes and then decide.

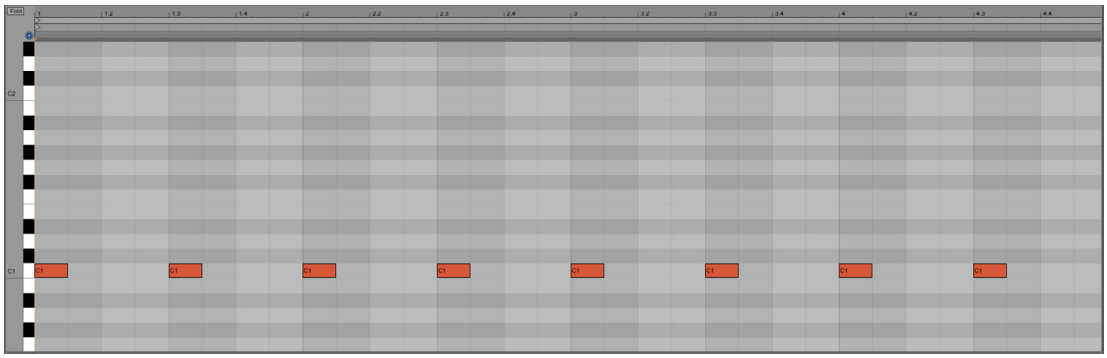
24.2 The Elements

There are five pitch elements that slowy enter and leave throughout the track. Each one is also constantly being minutely modulated with a variety of filters and effects.

In the diagram below, I've put in each of the pitch elements where I hear them enter for the first time. Each element continues on in the song for much longer, but for clarity's sake, I've only put them in on their first entrance.

The first element is in the bass. That constantly driving bass has a pitch to it, and it happensto be a C. It happens on beats one and three of nearly the entire song, paired with the kick drum.





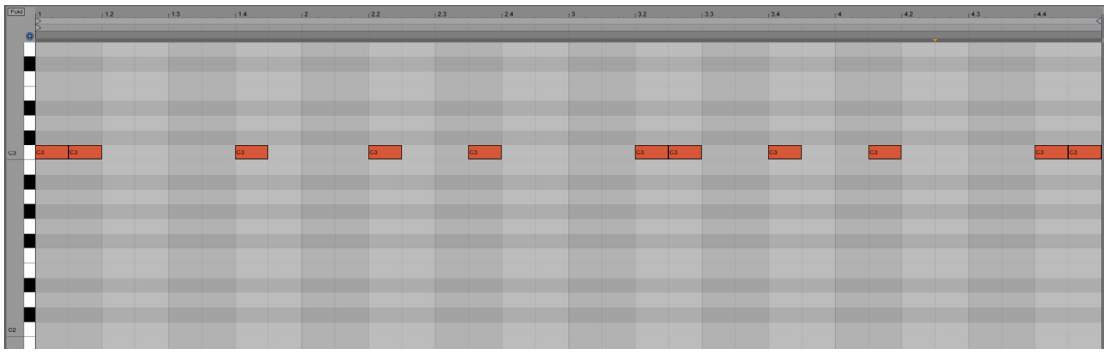
The second element, that enters around 40 seconds, is a higher synth in a syncopated rhythm. Syncopated rhythms are rhythms that "fight" the beat just a little bit. Usually they imply a different grouping of notes. Look again at the bass note above, and notice how there are four eighth notes for every hit in the bass synth and kick. This "syncopated" rhythm in the next element only has three notes for every hit in the bass synth. The three against four is what creates the syncopated effect.

The pitch here is E ♭, two octaves higher than the C in the first section.

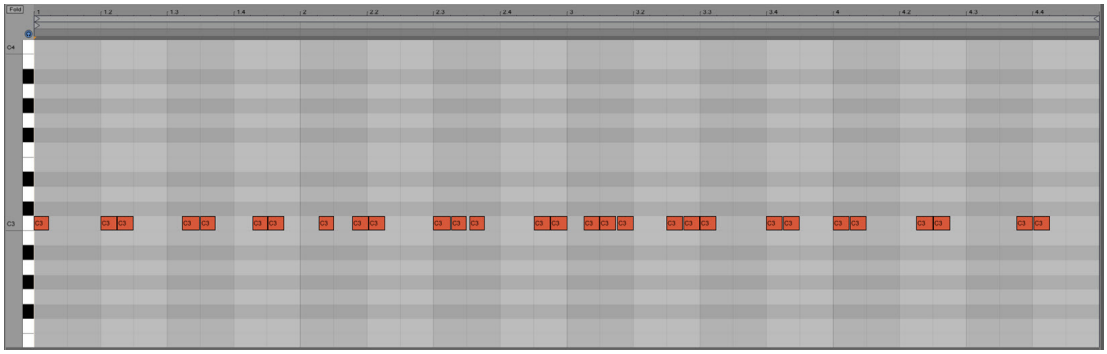
That means that so far we have the pitches C and E ♭. We've had a lot of C so far, so this really makes it look like we are hearing a C minor chord (We haven't had a G yet, which would complete the chord, but the root and the third is often enough to establish the chord) Let's keep exploring to see what else we have.

The third element begins to be audible around 55 seconds, and is another series of Cs. The pattern of notes here appears to be somewhat random: it doesn't consistently imply another meter, so we wouldn't call it syncopated. I think it was added to serve as more of a percussion effect.

It's hard to say exactly what octave this note is in because of the moving filter on it. It might be changing octaves, or just feels like it does because of the filter. Either way, it's another C.

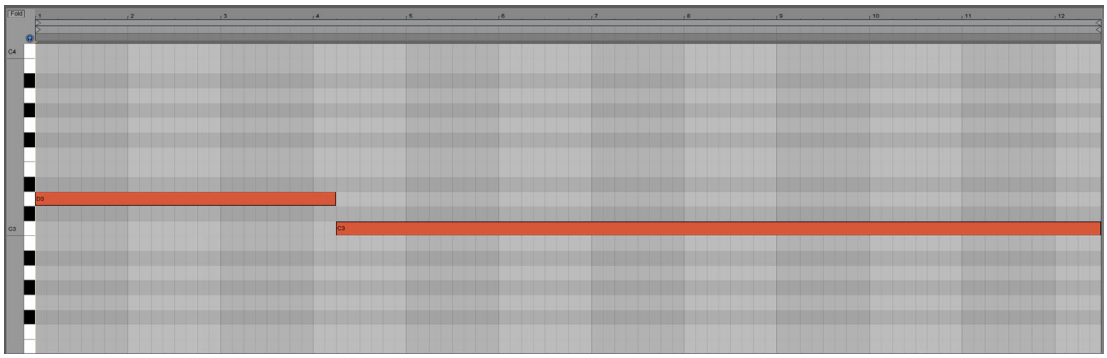


The fourth pitch element is almost a copy of the third, but lower, and again on a constant C. This one stays farther in the background and has a much more dark sound than the previous.



Finally, in the fifth element we get another pitch: D.

D? We might expect a G to give us the fifth of the C minor chord we are hearing. But instead we get the pitch D, briefly followed by another C. These two notes are the closest thing to a melody we get in this song. It enters at about four minutes into the track.


Fold
1
2
3
4
5
6
7
8
9
10
11
12
C4
D3
C3

24.3 The Pitches

How can we make sense of the D that enters in the fifth element?

It actually makes a lot of sense if you think about how this track feels, and what Hawtin is trying to achieve with this element: Tension. The D is in the key, but is dissonant against the C (and especially the E ♭). When it enters, there is a sense that something is "off," which is an effect that dissonance can have. In a few bars, the D resolves down to C, blending back in to the sea of Cs that are sounding.

At four minutes into an 11 minute track, it seems a good time to bring in something that will give the track a little extra tension. A major second above and half-step below the only other notes we've heard so far is as good of a way as any to achieve that.

This track, like a lot of the music Hawtin produces and plays, is a study in subtlety. It shows that it doesn't take a lot of notes or chords to create tension.

24.4 The Analysis

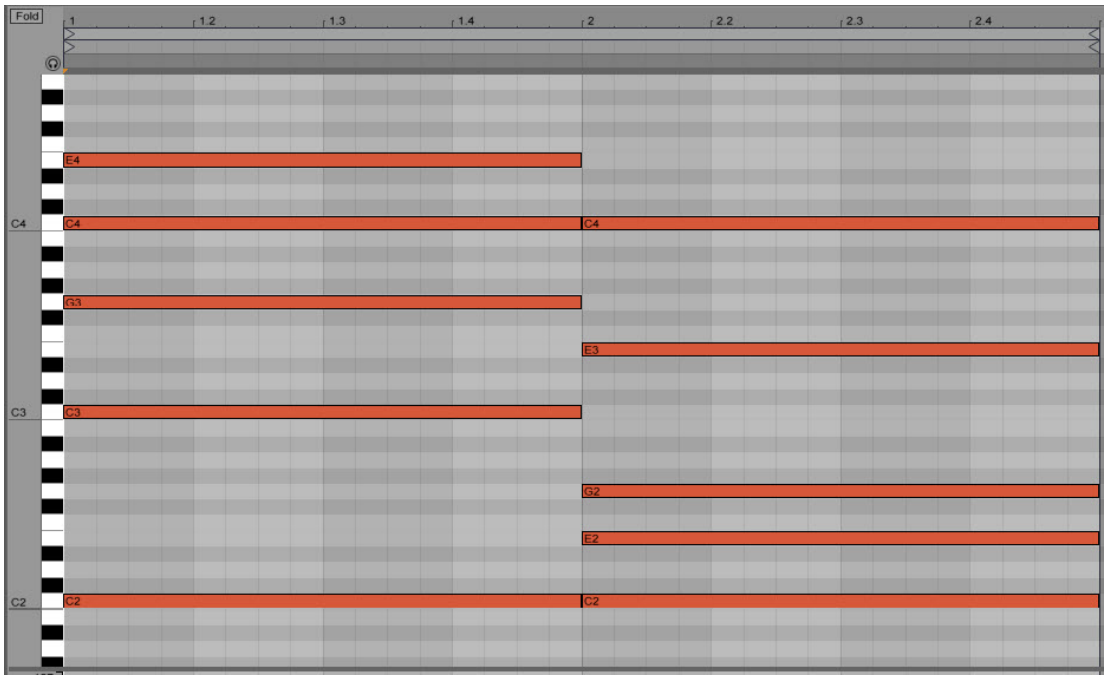
What we are hearing in this track is typical of a lot of techno and other styles of dance music: A single chord resonating throughout the entire track. We don't get anything other than a C minor chord (other than that lonely D pitch in the melody). But thats enough to call this track "in C minor". The whole song could be said to be sitting on a "i" chord in C minor. ►

25. Texture & Density

For centuries, composers have explored ways to build interesting textures in music. As electronic musicians, we have a virtually unlimited pallet of sounds to work with in order to add density and character to our music. In this chapter we will focus entirely on working just with harmonies that can give a sense of "thick," "thin," "coarse," or "smooth" textures, just to name a few.

25.1 Texture in Chords

It isn't something many people think about when putting together chords, but there is a relatively simple formula for making a chord sound thick or thin. The formula is this: put big spaces at the bottom and little spaces at the top to make a thin texture, and the opposite to make a thick texture. You can actually make the same chord sound really thick or thin with the same notes by using this formula. Let's try it with a C major chord.



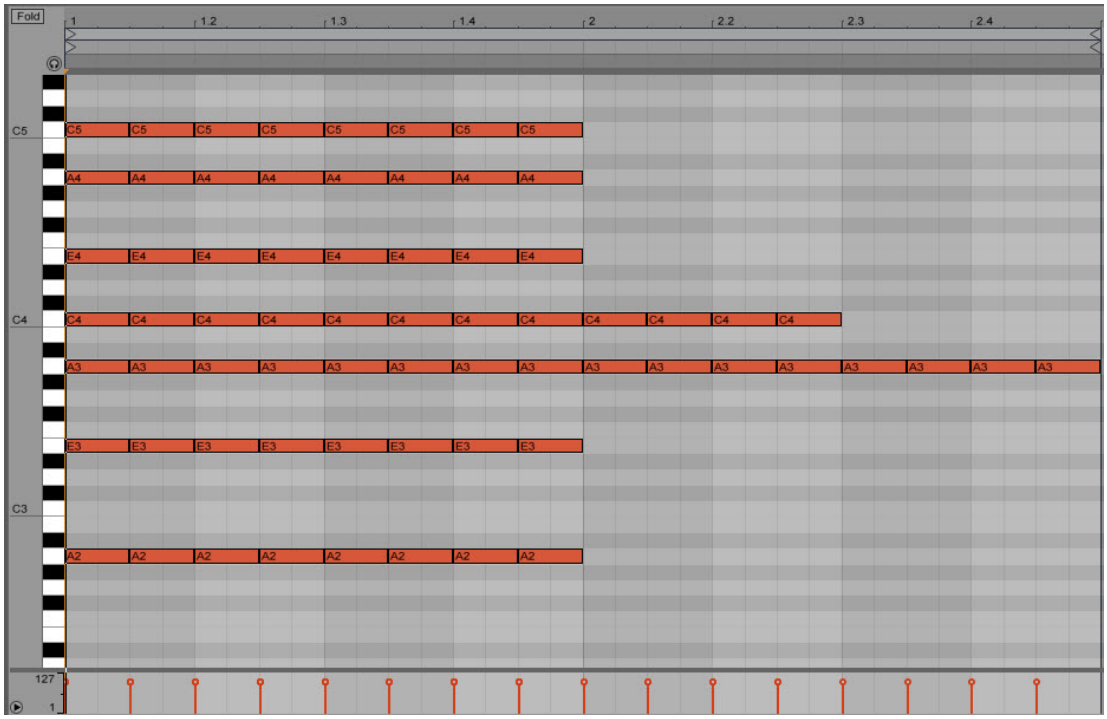
In this example we have two C Major chords. The first one has large gaps at the bottom of the chord, with the spaces between the notes getting smaller as you go up. This will result in a thin sounding chord. The second chord has small intervals between the notes at the bottom, and larger intervals as you go up. This will result in a thicker sounding chord.

This phenomenon happens because the first chord more closely emulates the overtone series - a pattern that is based in physics and is the guiding principal behind everything we've covered in this book so far. But, more important, is that we can use this to inform how we put together our chords. The texture of a chord can help create transitions, breaks, and give direction to a track.

Imagine you are working on a track and you have a four-chord progression. You get to a point in the song when you want everything to feel lighter, or thinner. But you don't want to stop the chord progression because you can use it for the build back into the bigger section of the track. You can use texture to arrange the chord to be more thin in that section -a trick that might not be incredibly noticeable to the listener, but will help with the momentum of your track. Alternating and manipulating textures with harmony is one of the most powerful yet underutilized tools in electronic music.

25.2 How Many Notes?

Building textures can be as simple as changing the number of notes in your chord. A chord with two notes will usually be thinner than a chord with five notes. But the psychological effect of the harmony can be maintained while you are adjusting the number of notes in the chord. Let's look at an example.



In this example we have an A minor triad. At first, the chord is being struck repeatedly with each note in several octaves. The chord is spaced out with some extra space at the bottom of the chord, but not very much. This will be a somewhat dense chord. As the chord reaches the second bar, it thins down to just two notes, and then one note. At that point, what does the listener feel? They will not feel a chord change. Even though we have lost most of the notes, in this context it will usually feel like we have the same chord continuing, but in a thinner texture. Even when we get to the last two beats when it is just a single note, the listener will still feel like this is an A minor chord because of what came before it.

25.3 Extended Harmony

So far in this chapter we have only looked at triads, but a similar way to create more density is to add more different notes to your chord. A 7th chord is denser than a triad. Every time you add a note outside of the triad, you make it feel much bigger than if you just added another octave of a note in the triad. When you are trying to build a chord with a thick texture, experiment with adding 7ths, 2nds, 6ths, 4ths, and even dissonant notes. ►

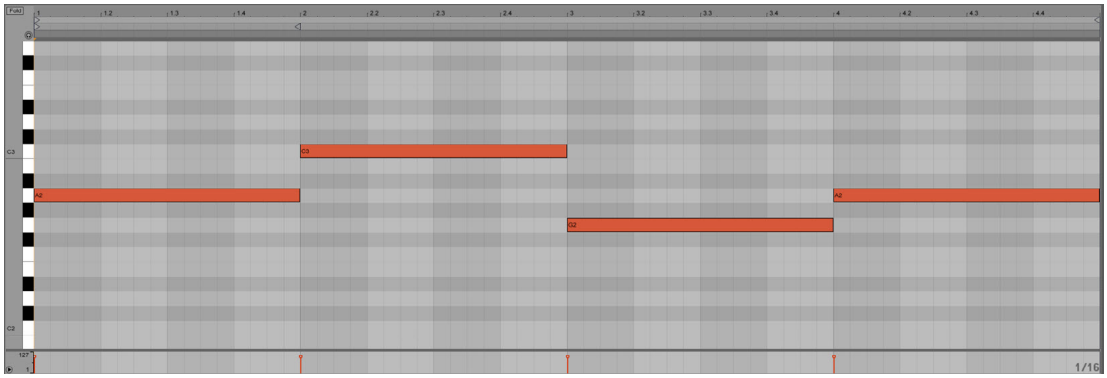
26. Song Analysis: Everything You Do Is A Balloon (Boards of Canada)

If you know the music of Boards of Canada, you know about chords that are "dense." They have a tendency to use chords with a few extra notes, do a little borrowing from neighboring keys, and even insert a few dissonant notes. They like to blur the lines of traditional harmony a little bit, and this song is no exception.

26.1 Density & Lines

Chords that have a lot of notes in them can be hard to decipher. It's particularly hard in the case of this song when there is no clear bass line. What we call the bass line is somewhat subjective, and could be heard a few different ways. For that reason, let's not look for the bass line in this song. Instead, let's focus on just finding a line in the song. A line, in this case, may or may not be the bass line. It might be just a series of notes inside the chords, at the top of the chords, or someplace else. All I know for sure is that each of these notes is in the chord that is happening at the same time. When there is no clear bass line, finding any line like this can be a useful starting point.

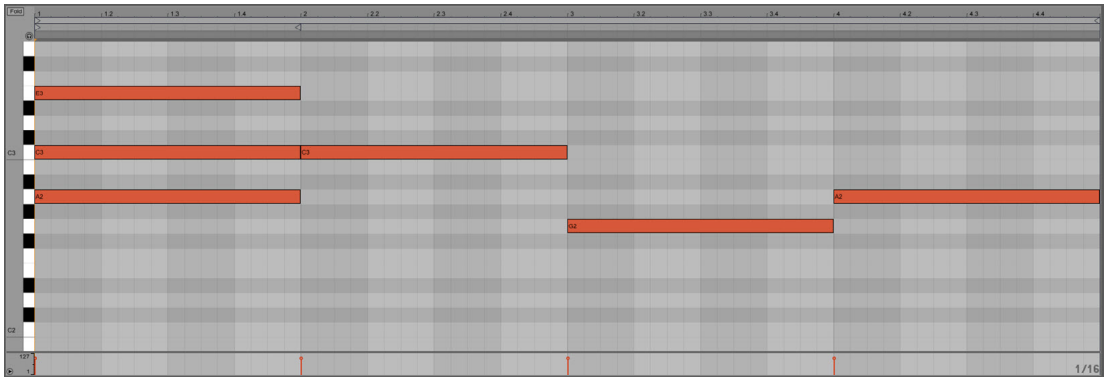
Let's jump to a part of the song where this churning chord progression is the most clear, right around 2:22. In the chord progression I can hear the notes A, C, G, and A, so let's use that as a line that we can start with.



26.2 The Chords

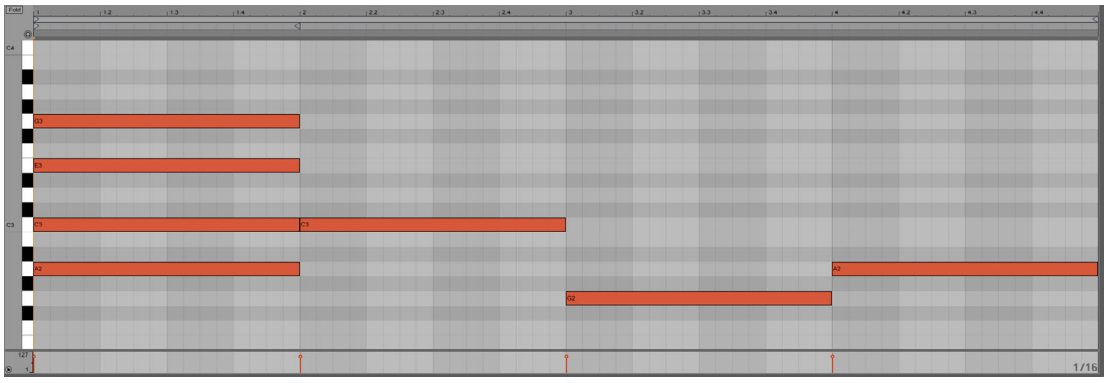
We have a four-chord repeating section throughout this part of the song. Let's step through each chord one at a time.

For the first chord, I found a A in it. Since we don't know where else to go, let's just start by building an A chord on top of it and see how it sounds. This song has an overwhelming "minor" feel to it, so I'm going to take a guess at an A minor.



Try putting this in and listening to it closely. It's not quite right, but in what way is it wrong?

It sounds to me like all the notes we have are correct, but it's missing something. Let's try adding a 7th to our A minor chord, to make an A minor 7th chord.

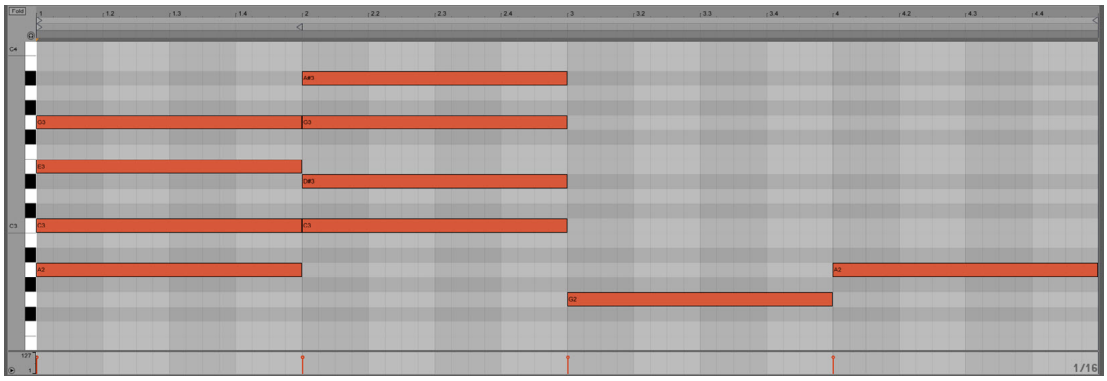


That sounds right. Let's call our first chord an Am7.

What about the roman numeral? We can't give it a roman numeral quite yet, because we don't yet know what key we are in. Let's figure out the next chord and come back to the key after we have more information.

For the second chord, we have a C that we originally found. So let's start by building a C triad on top of it. Should it be major or minor? Since we don't know our key yet, we don't know for sure yet, but there is a clue. Our previous chord has the interval C-E in it, so that points us to using a C major chord here. Give that a try, and see how it sounds.

Not quite right - but close. Try a C minor triad. Much better. But still missing something. If all the notes we have sound right, but it still sounds like its missing something, the odds are good that we need to add a 7th to our chord. So let's try adding a Bb (a 7th above our C) to the chord.



For the third chord, we have a G. Let's go back to square one - the same place we started before, by just building a G minor triad from that G note of the third chord.

Because we've used two 7th chords already, I followed a hunch and put the 7th in the G minor chord, making a Gm7. I'm pretty happy with how that sounds. What we have so far is Am7, Cm7, and Gm7.

26.3 The Key

At this point we have three chords, so let's take a stab at figuring out our key. The best place to start would be our first chord, so lets see if this works in the key of A minor. The first chord works in A minor, the second chord (Cm7) doesn't - it would be a C major 7 in the key of A minor, and the third chord (Gm7) would be a a G major 7 in the key of A minor. So we have one chord out of three that works in A minor.

Let's try the second chord: C minor. The first chord (Am7) isn't in the key of C minor at all - it would be an Ab Major chord. The second chord (Cm7) works fine in the key of C minor, and so does the third chord, Gm7. Two out of three.

Let's try the third chord: G minor. The first chord (Am7) would be a diminished chord in G minor. The second chord (Cm7) works in G minor, and the third chord works in G minor.

Of all three options, G minor is the best. The first chord (Am7) has been converted from a diminished chord to a minor chord, which isn't very uncommon. We could explain it by using the melodic minor scale for that chord to raise the 6th scale degree, or we could just say that they liked the sound of the minor 7th better than the diminished 7th.

26.4 The Last Chord

For the last chord, we originally found an A. So let's try building an A triad on it. Now that we know we are in the key of G minor, we know that we should be using an A diminished chord - the iiº chord in G minor. However, we've already seen that in the first chord they changed the iiº to a iim7, so it stands to reason that they would do it again. Let's try just an A minor triad here.

Do you hear the 7th in this chord? Maybe. There is a lot going on, I could go either way on the 7th being in the chord. I kind of like it without adding the seventh, so I'm going to leave it off.

26.5 The Analysis

Now that we know our key and our four chords, let's look at the roman numerals.

ii7 - iv7 - i7 - ii7

Remember that we wouldn't typically notate "m7" here because in roman numerals, adding "7" means "the 7 that is in the key". So we do not need to specify that we are adding a minor 7th, because all of the 7ths are in the key.

How did they come up with that?
Do we think that the producers in Boards of Canada sat around a table and had the following conversion?

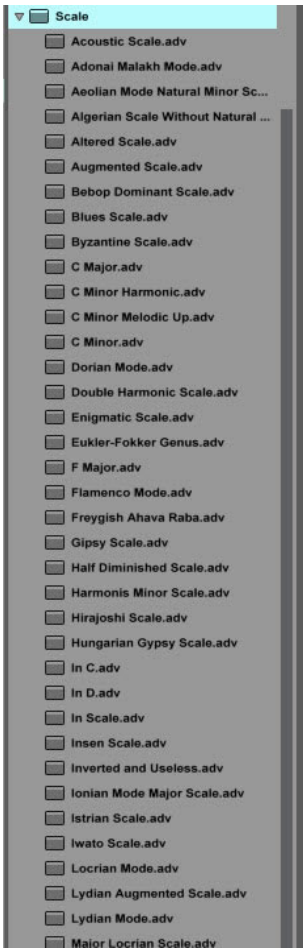
"Ok, let's make a track in G minor that starts on the IIº, but let's put the 7th at the bottom and then raise the it's a minor instead of a diminished, then lets move to a Cm7 chord, then down to the Gm7 that is our key and with that iiº chord again, converted to a minor by borrowing from the melodic minor."

No.
Of course not.
They probably put their hands on a keyboard and started messing around until they found a series of chords liked. They used their ear. It's useful to us to analyze what they did using keys, chords, and roman numerals we can figure out what they did and learn from it. ►

27. Modes

We've learned that major keys are made up of major scales, and tend to have a "happy" sound. Minor keys are made up of minor scales and tend to have a "sad" sound. But music is capable of more emotions than just those two. In fact, there are many more scales that can be used to refine the emotive quality of a harmony than just major and minor.

27.1 What is a Scale?



Let's go all the way back to chapter seven and remember what defines a scale. A scale is a series of half-steps and whole-steps that span an octave. The pattern of half-steps and whole-steps tell us if it is a major scale or a minor scale. If the pattern is W-W-H-W-W-W-H, it's a major scale.

If the pattern is W-H-W-W-H-W-W, it's a minor scale. But what if the pattern is anything else?

There are potentially hundreds of combinations of whole and half steps. We've only used two of those combinations so far: the major pattern and the minor pattern. Maybe you've seen a list of scales in the Ableton Live scale object, the Push 2 settings, or some other device. No list of scales you will see is ever complete - there are just too many.

Each scale has its own "flavor" - in the same way the major and minor scales evoke certain feelings, these other scales have a feeling to them as well. Each one is unique.

27.2 A Little History

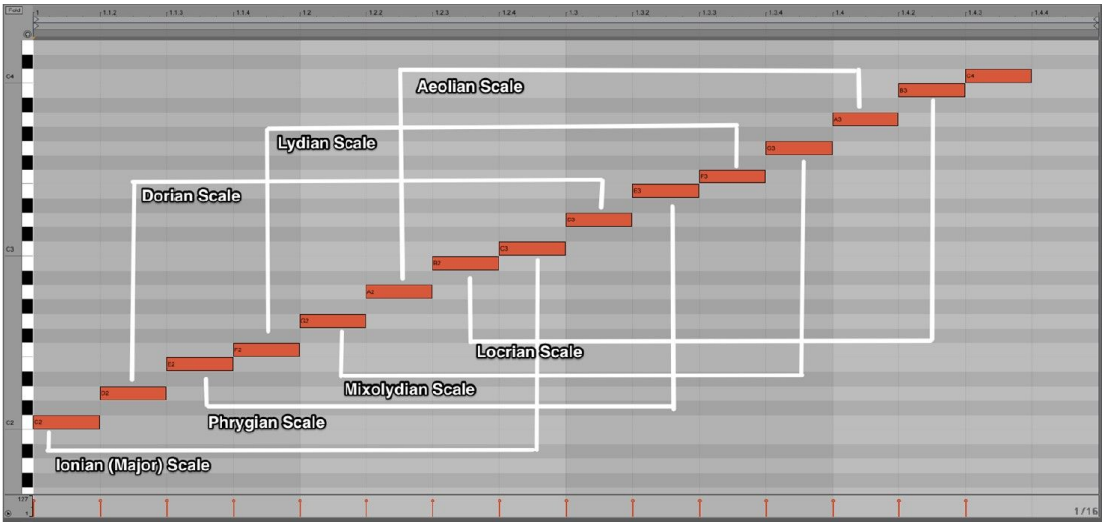
Back in the middle ages, when our understanding of harmony was being solidified, there were actually seven different scales that were used for most music. After a few hundred years of usage, one of them filtered to the top as the one used most often, for most music. We started calling that one the "major" scale because it was the most important. A second scale also drifted to the top of the list of seven as being used more often than the others, but not quite as much as the "major" scale. We started calling that one the "minor" scale.

The original seven we now call "modes." The seven modes are Ionian, Dorian, Phrygian, Lydian, Mixolydian, Aeolian, and Locrian. The Ionian scale is the one that was renamed the Major scale, and the Aeolian is the one that was renamed the minor scale.

27.3 Mode Shifting

Maybe you just noticed something familiar. If the first of the seven modes is the Major scale, and the sixth of the modes is the minor, it looks a lot like our relative major and minor scales. Remember that if we are in the key of C major, we can go up a 6th to find our relative minor scale (A minor, in this case). If we switch our vocabulary around just a little bit, and say we are going up a 6th to find the Aeolian mode, then we can also say we go up a second to find the Dorian mode, up a third to find the Phyrigian mode, a fourth to find the Lydian mode, and so on.

This is actually the easiest way to understand the modes. Take a C major scale, but pretended D is the root. Don't change any notes - we are still working with the notes of C major, but using D as the root. You now have a D Dorian scale. If we stick with that C major scale, but treat E as the root, we now have an E Phyrigian scale. Starting on F would make a Lydian scale, G a Mixolydian scale, A an aeolian scale (the relative minor), and B a Locrian scale.



Let's look at these from the other direction.

If we wanted to find an F# Phrygian scale, for example: Phyrgian is the third mode, so we would find a the major scale in which F# is the third note. If we count down from F# (down the scale, which would be all whole-steps to get from the third to the root), we would count F# - E - D.

The answer is D. To make the F# Phyrigian scale, we would use all the notes of the key of D, but treat F# as the root.

Let's do one more. How about a C Mixolydian scale. Mixolydian is the fifth mode, so we need to find a scale that C is the fifth note of. Let's count the major scale pattern down from the fifth, starting on C: whole step down to Bb (the fourth), half step down to A (the third), whole step down to G (the second), whole step down to F (the root). Therefore, in order to make a C Mixolydian scale, we use the notes of F major, with C as the root.

27.4 Mode Qualities

Another way to look at the modes is to start with a major or minor scale and look at how they are different. This will also tell us a little bit about the quality of each mode. Some are more major sounding, others are more minor sounding. Let's look at each one, in order.

1. Ionian:
   This is the major scale, with no alternations.
2. Dorian:
   The Dorian scale is a minor scale with a raised 6th scale degree. The raised 6th gives it a slight bit of major, so you can think of this one as being in-between the major and minor scales.
3. Phyrigian:
   The Phyrigian scale is a minor scale with a lowered 2nd scale degree. That gives it a half-step at the very bottom which makes it a little more eerie than your normal minor scale.
4. Lydian:
   The Lydian mode is a major scale with a raised 4th scale degree. That raised 4th gives it an extra bright feeling, almost like a "super major".
5. Mixolydian:
   The Mixolydian scale is a major scale with a lowered 7th scale degree. The feeling of the lowered 7th makes it have a similar "edge" that the dominant 7th chord has.
6. Aeolian:
   This is the natural minor scale, with no alterations.
7. Locrian:
   Locrian is the strangest of all the modes. It is a minor scale with a lowered 2nd scale degree and a lowered 5th scale degree. This one is pure evil.

27.5 Using Modes

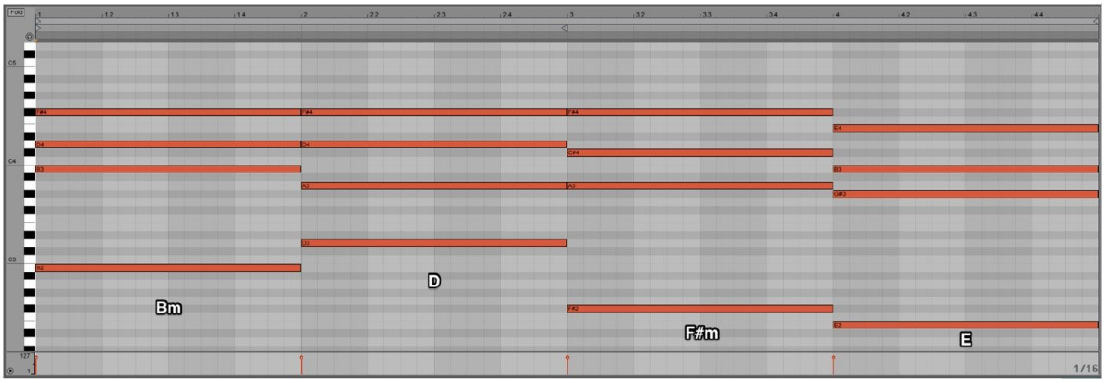
You are now armed with five more scales to build your harmonies on. If you make the diatonic chord progression with these scales, each one will have something unique to it that you don't get in the "regular" major or minor scales. You can use the modes to create a different feeling in your music if you are tired of using major and minor. The next time you are coming up with a chord progression and are looking for a slightly different sound, try switching over to one of the modes. The most commonly used modes in electronic music are probably Dorian and Phyrigian. ►

28. Song Analysis: Get Lucky (Daft Punk)

Daft Punk is known for fairly simple harmonies that repeat in predictable patterns. They are not exceptionally "thick," so we know not to look for 7th chords or added notes. While it has a simple exterior, the harmony of Get Lucky does have a surprise inside.

28.1 The Chords

Let's take a little bit different approach for this analysis. I'll give you the chords and the bass line and lets figure out the key together.



Our four chords are B minor, D major, F# minor, and E major. What key are we in?

Let's look at all of our potential keys in a grid. Making a grid like this can be useful for telling us what chords are in what key.

Chords:	Bm	D	F#m	E
Key of E:	N	N	Y	Y
Key of Bm:	Y	Y	Y	N
Key of D:	Y	Y	Y	N
Key of F#m:	Y	Y	Y	Y

From this grid we can see that all the chords work in the key of F#m. We can also see that only half the chords work in E major. So our most likely key at this point is F#m, and our least likely key is E Major.

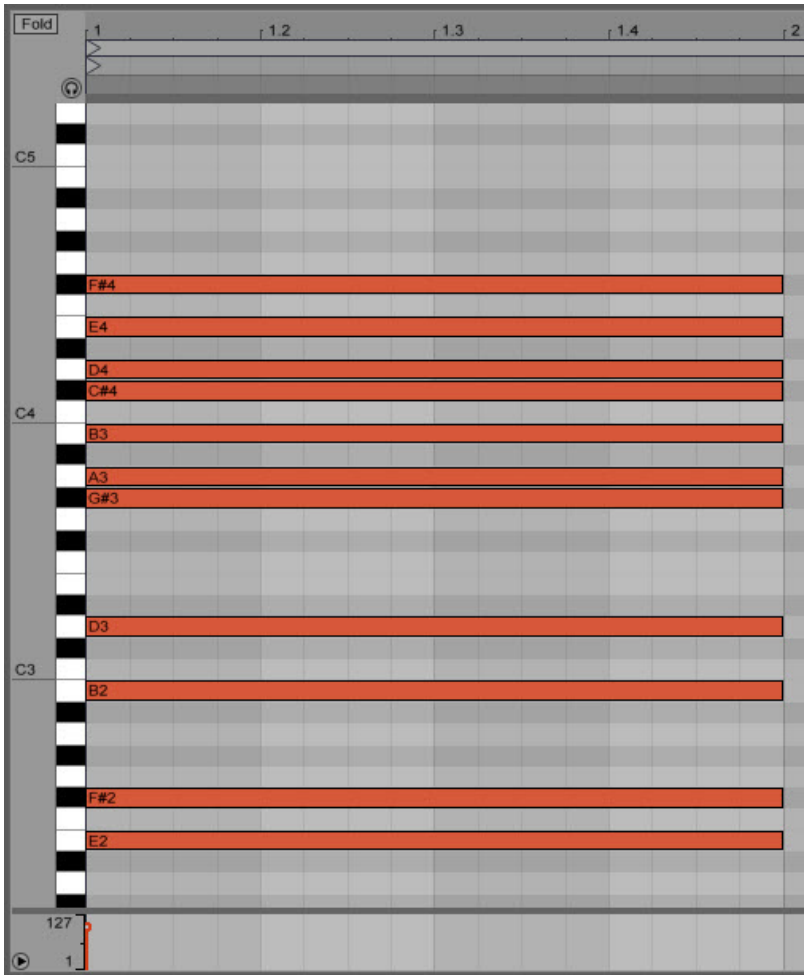
28.2 The Key

Let's examine the key of F#m a little bit more. Remember that one of the rules for the key is that it has to feel like "home". We need to feel like the song could end on that chord. Listen to the chord progression (or the song), and stop it on the F#m chord. Does that chord feel like it is waiting to go somewhere? Or is it stable where it is?

To me, stopping on the F#m chord feels a little bit like I'm holding my breath. I'm waiting for the next chord to exhale and then the first chord to end on. The B minor feels like "home". That's where we can stop. It's also the first chord, which is a good clue as to what the key is.

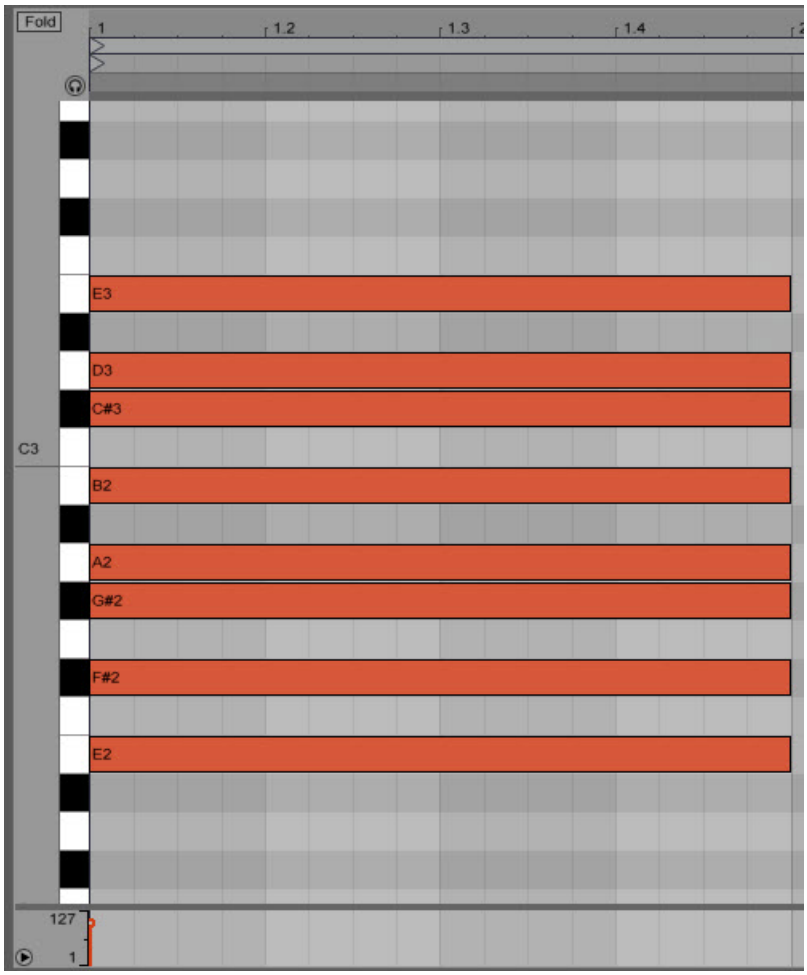
However, we have this E major chord that doesn't fit. We might have to put on our theory hats to solve this one.

28.3 Modal Harmony



All the way back at the beginning of this book, we started finding the key by first finding the scale. Let's go back to that technique. If I take all the notes in the song - every note in every chord - and delete the duplicates, the remaining notes are E, F#, B, D, G#, A, and C#.

Next, just like we did before, let's compress these into one octave.



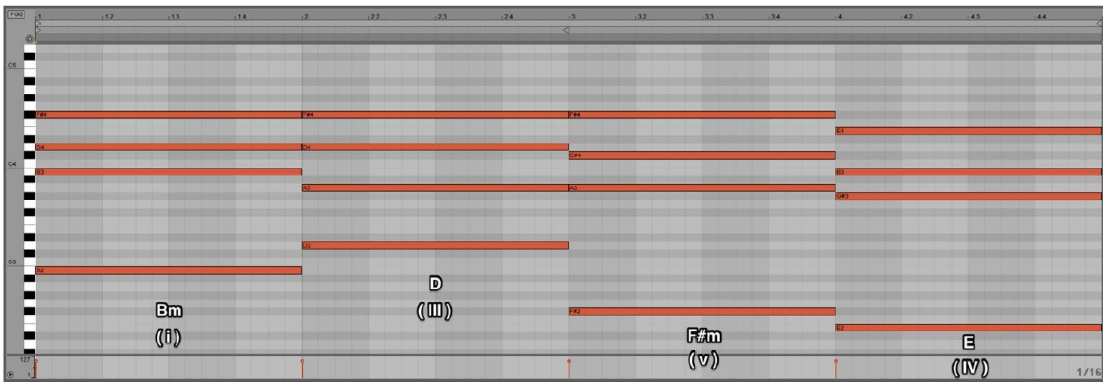
This is starting to look like a scale. Finding the root of this scale should be pretty definitive when it comes to what our key is. When you are looking at notes like this and trying to find the root, a quick way is to look for the half steps. The half steps in a major scale are between the 3rd, 4th, 7th, and the root. Because our half steps here are G#/A and C#/D, our root must be either A or D. If you count around to find the pattern, we will end up determining the root is A. This is an A major scale.

Now, let's think about this for a minute. All our notes put together end up being in A major.

But there is no A major chord in our song, and in fact we've already determined that B minor is the best fit for our key. In what case can B minor be our key when we are using all the notes of A major? It's almost a riddle: when is A major actually B minor?

The answer is: when it's actually B Dorian.

If we take the notes of the A major scale, but treat B as the root (without changing any of the notes), we end up with a B Dorian scale. If we built chords on a B Dorian scale we would get Bm, D major, F#m, and E major.



28.4 The Analysis

We can call the key of this song B Dorian. In that key we have a fairly simple chord progression:

i - III - v - IV

29. Chromaticism

What we've been looking at in this book is a concept of music theory that was developedhundreds of years ago. Over the course of a few centuries the concept of a "good" sound and a "bad" sound has evolved because of composers and producers pushing the boundaries. One way this plays out is in what we call "Chromatic" music. The term chromatic comes from the Greek for "colorful." Chromatic music displays many more colors than music based on just a major scale.

Around the 1950s, (and really as early as the 19th century) those boundaries got pushed so far that the system of harmony that we had been using (and have been using in this book) didn't work anymore. Orchestra composers started developing new systems that governed "good" and "bad" sounding music. This music, to us, sounds completely chromatic. The idea behind chromatic music at the time was that all pitches should be treated equally*. A C# is no more important than a D#. In order for that to be true, there can be no key, no chord (at least as we understand them), and no scale.

> * This was only one of many ideas floating around about how "modern" harmony should work, and composers at the time experimented with many different ways of organizing pitches.

Completely chromatic music can be fascinating, and I encourage you to listen to it. Listen to some music by composers like Luigi Nono, György Ligeti, Anton Webern, and many others. There is a treasure of music to be discovered in chromatic music (also sometimes called atonal music.)

Remember that music progresses only because there are people making music that are willing to experiment and push the envelope. Don't be afraid to go outside of the key in yourtrack - by a little, or by a lot. Music theory is a constantly evolving language the relies on experimentation. ►

30. Epilogue

Rule No. 1: Don't let music theory be a bully. Your ear always wins.

In the introduction to this book, I gave you this as the "number one rule of music theory." Over the course of these chapters we've learned how to put notes together to make interesting chords, chords that work with other chords, and some interesting ways to use those chords. We've looked at how different artists, producers, and composers have used harmony in their music, and how we can dissect those progressions for our own usage. We've covered a lot of ground.

One question I get asked a lot is, "How should I be thinking when I'm working on a track?" In other words: should I be thinking about chords, keys, roman numerals, diatonic chord progressions, and everything else? Or should I just be experimenting?

Everyone has their own way of working, but what I hope you take away from this book is that you can do both. You can block out all the music theory and just experiment until you find something that you like, and then you can use what you've learned here to expand and build on it. Or you can start a track by thinking about a progression: maybe you like the sound of a minor iv chord to a minor i. Use that as a basis, and then start experimenting with it.

What about when you get stuck? The next time you are working on a track and you get stuck, think about all of your possible options for chords. Use

the circle of fifths, the diatonic chord progression, seventh chords, accompaniment styles, dissonance, texture, and anything else you've learned in this book to get unstuck. Maybe one of those elements will give you a new idea, and maybe it triggers a jumping-off point that helps you to finish the track.

The one thing you should never, ever, do is find a sound that you like and decide not to use it because you can't explain it with music theory. If you find a chord that you love but can't analyze, consider yourself progressive and innovative. Name the chord after yourself or your track - composers have been doing this for years (look up the "Petrushka Chord," for example).

After all is said and done, use music theory to help you explore, not to inhibit your exploration. Your ear always wins. ►

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Appendix: Common Chord Progressions

Below is a list of common chord progressions.

If you get stuck, need an idea, or just a fresh place to start your track, you can try using one of these. By using the roman numerals you can put these into any key.

Roman Numerals	Chords in C Major
I - IV - V	C - F - G
I - vi - IV - V	C - Am - F - G
ii - V - I	Dm - G - C
I - vi - ii - V	C - Am - Dm - G
I - V - vi - IV	C - G - Am - F
I - IV - vi - V	C - F - Am - G
I - iii - IV - V	C - Em - F - G
I - IV - I - V	C - F - C - G
I - IV - ii - V	C - F - Dm - G

About the Author

J. Anthony Allen has worn the hats of composer, producer, songwriter, engineer, sound designer, DJ, remix artist, multi-media artist, performer, inventor, and entrepreneur. Allen is a versatile creator whose diverse project experience ranges from works written for the orchestra to pieces developed for film, TV , and radio.

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